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FIG. 1.—HARVESTING ROTUNDIFOLIA GRAPES BY THE JARRING METHOD AT THE MEDOC VINEYARD, NEAR ENFIELD, N. C.

FIG. 2.—GENERAL VIEW OF BLOCKS 1 AND 2 OF THE ROTUNDIFOLIA EXPERIMENT VINEYARD AT WILLARD, N. C.

Issued May 5, 1913.

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B. T. GALLOWAY, *Chief of Bureau.*

THE MUSCADINE GRAPES.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., July 13, 1912.

Sir: I have the honor to transmit herewith a manuscript entitled "The Muscadine Grapes" and to recommend that it be published as Bulletin No. 273 of the series of this Bureau. This bulletin has been prepared by Mr. George C. Husmann, Pomologist in Charge of Viticultural Investigations, assisted by Mr. Charles Dearing, Scientific Assistant, and was submitted by Mr. A. V. Stubenrauch, Pomologist in Charge of Field Investigations in Pomology, with a view to its publication.

This bulletin brings together comprehensive information and data regarding the Muscadine-grape industry, giving also an outline of cooperative experimental work in progress on the Pender Test Farm of the Department of Agriculture of North Carolina, and the information presented is thought to be of fundamental importance to those interested in the culture of this fruit. This industry is assuming important proportions, and the investigations have in view the determination of the factors underlying the improvement of cultural conditions and methods of disposing of the crops.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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THE MUSCADINE GRAPES.

INTRODUCTION.

During the last decade a general industrial and agricultural awakening has been in progress in the South Atlantic and Gulf States. Rapid advancement has been made along many lines. Commercial and manufacturing industries are making their appearance on all sides and great strides have also been made in agricultural development. The existing labor and other conditions render urgent the development of more varied agricultural pursuits and also demand that other lines besides those commonly followed be taken up. The destruction of the forests as a result of the turpentine and lumber industries calls for the utilization of the denuded lands, and there is thus abundant opportunity for agricultural undertakings.

The horticultural development of this, as of all other sections, depends to a very great extent upon the native fruits of the region. The South is rich in native fruits, but even among the most important of these none are more promising, none will adjust themselves so well to the diverse conditions, none will yield fruit for which there are so many uses or for which such large returns for time and means expended are received as the Muscadine grapes.

The purpose of this bulletin is to give some glimpses of the past and present condition of the Muscadine grape industry, to call attention to some of its possibilities, and to indicate the important problems in the industry that require solution. It is intended as a report of the viticultural investigations of the Bureau of Plant Industry in Muscadine regions from 1905 to 1911, including both a discussion of the results already accomplished and a description of the important researches that are under way.

PRESENT STATUS OF THE MUSCADINE-GRAPE INDUSTRY.

That part of the United States in which the Muscadine grapes are native and where soil, climatic, and other conditions suited to them are found embraces an area of not less than 400,000 square miles, or more than 250,000,000 acres, a large portion of which is now unused. This district includes the entire southeastern Coastal Plain from the James River to Florida, reaching well up into the Blue Ridge Moun-

tains; from Florida it extends along the Gulf coast to the Rio Grande, and also northward along the Mississippi River to southeastern Missouri and the Tennessee River.

A preliminary survey of the Muscadine grape industry shows that, while it is more advanced in some places than in others, it is as yet comparatively undeveloped. The commercial varieties have been slightly distributed, but the adaptability of varieties to varying soil, climatic, and other conditions has not been studied, nor has the relative value of different varieties for particular uses been determined. The best known systems of growing and training the vines are of the crudest nature. Aside from a very few large commercial vineyards where the product is made into wine and in which more advanced methods are gradually being introduced, the growing of Muscadine grapes has been largely for home use and limited to local trade. We also find that of all grape species the Muscadinia are the most resistant to *Phylloxera vastatrix,* or root louse, which is so destructive to the Vinifera species. They are also apparently less subject to the various fungous diseases so troublesome to other species when planted in the Muscadine region. They are able to adapt themselves to many different environments and yield good results with practically no care.

The investigators of the Department of Agriculture have long appreciated the many possibilities of this group of grapes under southern conditions. In 1905 a series of investigations was begun with the object of encouraging the planting of the vines and also in order to assist in developing a large and profitable industry. These investigations were started by and are still being continued under the direction of the senior writer of this bulletin, who was assisted from August, 1905, to March 1, 1908, by Mr. E. F. Cole, scientific assistant, and since March 1, 1910, by the junior writer.

Extensive field surveys have been made in order to study the species in their native habitat and to make a close botanical and viticultural investigation of the species; to trace the history of the few cultivated and better known varieties and locate others of merit; to study the relation of varieties to soils in which and the conditions under which they thrive best; to assemble and grow for observation, study, and comparison, the varieties located; to devise better methods of culture and of supporting and training Rotundifolia; to ascertain the value of the fruit for diverse purposes, and to improve on the methods of marketing and preserving it.

THE COOPERATIVE ROTUNDIFOLIA EXPERIMENT VINEYARD.

In 1907 arrangements were completed for the establishment of a cooperative experiment vineyard of 15 acres located on the Pender test farm of the North Carolina State Board of Agriculture at Wil-

ard, N. C., and an agreement was made with the board relative to the maintenance and care of the plat.

In 1908, 60 plants each of the 6 leading commercial Rotundifolia varieties were planted in regular checks for the purpose of testing diverse methods of pruning and training, while 779 seedlings of Rotundifolia and Rotundifolia hybrids grown from seed at the Arlington Farm were also planted for observation and study. (Pl. I., fig. 2.) With a view to procuring plants of promising Rotundifolia and Munsoniana varieties, heretofore located in field surveys, to grow these for observation, comparison, and study, and to determine the feasibility of propagating such varieties from cuttings, cuttings of 44 varieties procured from different persons were planted in the nursery.

In 1909 plantings in a varietal collection vineyard were commenced from plants of varieties grown in the nursery, and 23 varieties have been planted in regular checks to be grown for comparison and study. From seed obtained through previous pollinating work, 1,030 seedlings were grown and planted on the Pender farm for observation and study, adjoining previous plantings from a similar source.

In 1910 trellises and arbors were erected in the Rotundifolia experiment vineyard, on which to train the vines of the six standard Rotundifolia varieties in regular checks, and a series of pruning and training experiments was undertaken in order to improve on the crude methods followed in commercial vineyards and to determine the system best suited to Rotundifolia vines. Thirty additional varieties were planted in the varietal collection vineyard. On account of the exceedingly wet weather that prevailed during July and August, 1910, and the poor drainage of the land, these were not very successful.

There are 952 of the seedlings planted in the spring of 1908 and 1909 alive and growing under test. Of these, 570 are straight Rotundifolia crosses, of which 290, or 39.1 per cent, have bloomed, 98, or 33.7 per cent, of these being pistillate. In a score made of the vines as to vigor, that of the female vines was 90.66 per cent and of the male vines 89.3 per cent.

In 1911 additional plantings of 108 vines of standard varieties and 34 vines of newer varieties were made. Comprehensive propagation experiments were started. Cuttings of new natural varieties located in field surveys, of standard varieties, and of promising seedlings in the breeding block were assembled and planted in the nursery. Bench grafts to the number of 250, 114 field grafts, and a number of layers were made. Extensive experiments were conducted in the spring as a continuation of the pollination and breeding studies of Muscadine grapes, and the keeping of phenological notes was also begun.

BOTANICAL RELATION AND CLASSIFICATION OF THE MUSCADINIA.

All grapes belong to the genus Vitis, or that portion of the large family of plants known as the Vitaceæ or vine family which has naked-tipped tendrils and edible, pulpy berries. This genus is divided into two groups, the Euvitis and the Muscadinia. The varieties of the Euvitis group have loose, shreddy bark, forked tendrils, solid nodes, pith not continuous, and wrinkled seeds neither flat nor transverse. To this group belong all the species of Vitis except the Rotundifolia and the Munsoniana, which form the Muscadinia group, having the bark closely adherent on the young branches, the pith continuous through the nodes, the tendrils single, and the seeds flattened, with transverse wrinkles on the sides. The Rotundifolia have large berries with large seeds and the Munsoniana have small berries with small seeds. (Pl. II, fig. 1.) Besides the distinct characteristics mentioned the Muscadinia, commonly called "Muscadine grapes," are sometimes called "berry grapes" on account of the tendency of the individual berries of most of the varieties to shell and fall from the bunch as they ripen, whereas most varieties of the species belonging to the Euvitis group, often called "bunch grapes," ripen in clusters and are harvested as such.

VITIS ROTUNDIFOLIA.

Vitis rotundifolia is by far the more important of the two Muscadinia species, because all the prominent cultivated varieties belong to it. Rotundifolia vines are found wild in the woods and swamps, along rivers and roadsides, and in fence corners throughout the Coastal Plains and Piedmont sections of southern and southeastern United States. In favored locations they are found growing in great profusion, climbing to the tops of the tallest trees and trailing over the smaller trees and shrubs. When growing in the shade, especially in moist places, numerous aerial roots grow downward from the branches and if they reach to the ground often strike roots, thus becoming the means of the plants dividing into parts and propagating themselves.

The Rotundifolia have hard wood, and while the bark adheres very closely on the young branches, it sheds annually on the older wood and especially on the trunks of vigorous growing vines, but is never as shreddy as the bark of the Euvitis group. The trunks have a tendency to split into several parts as the vines grow old (fig. 1), though vines known to be a hundred years old often have solid treelike trunks. The wood varies in color from ashy gray to grayish brown, or sometimes yellowish brown, the young branches being covered with numerous small, prominent, warty lenticels. The

shoots are yellowish or reddish at the tip when young, are short jointed, angled, or sometimes flattened, and have intermittent, relatively long, tough, and strong, simple (unforked) tendrils of about the same color as the twig to which they belong. When permitted to

FIG. 1.—Trunk of an old Rotundifolia grapevine.

do so, the tendrils may foreshorten the young shoots, and sometimes when they encircle large branches need to be cut to prevent them from girdling and destroying them. The leaves are below medium size, more or less round to broadly cordate, with a wide, relatively

shallow basal sinus, generally not lobed, rarely slightly three-lobed, smooth and glabrous above and underneath, though there is sometimes a slight pubescence along the veins on the under side; margin serrate, with obtuse wide teeth. The color of the foliage varies from light to dark green, and the young foliage of the dark-fruiting varieties often gives the vine a reddish tinge in the early part of the season. The fruit clusters are more or less roundish, ranging from loose to compact, and are relatively small, sometimes having 1 to 30 but generally 4 to 10 berries, the peduncle and pedicels are short, the berries are globular, sometimes slightly ovate or obovate, varying in color from green, pearly, or bronze to black, generally more or less covered with reddish or russet dots, the aroma is strong and peculiar to the group, the skin is usually thick and tough, although thin in some varieties, and the pulp varies with the varieties from meaty to melting and juicy. In most varieties the fruit ripens unevenly, the berries dropping more or less from the cluster when ripe. The seeds average two to four in number, are medium to very large, flattened, shallow, and broadly notched, with a very short pointed beak, and narrow raphe and chalaza surrounded by radiating wrinkles. The leafing, flowering, and fruiting periods are very late. In most cases the blossoms of the fruiting vines are practically self-sterile and subject to serious attacks of black-rot.

In the wild state *Vitis rotundifolia* has been known under such names as Bullace, Bullis, Muscadine, Fox, Mustang, and others less common. It is often referred to in the history of the discovery and settlement of the southeastern United States. It is native where it is now found wild. Adams and Barlowe, of Sir Walter Raleigh's colony which landed in Virginia in 1584, apparently referred to it when they stated:

> On the 27th day of April in the year of our redemption 1584, we departed from England with two boats, well furnished with men and victuals, and found Roanoke Island on the 4th of July, and the smell was as sweet as if we had been in the midst of some delicate garden, and grapes grew abundantly—every shrub was covered, climbing toward the tops of the high cedars and we think the like is not to be found.

There are different species of grapes growing on Roanoke Island at present, but the Rotundifolia vines are greatly in excess of the others. There are no cedars anywhere near the supposed location of the Raleigh camp, but pines are numerous on the island and many of them are overgrown with Rotundifolia. The fruit even of wild Rotundifolia is esteemed and when ripe is gathered for culinary purposes from the vines known to bear the best fruit. The cultivated varieties are accidentally discovered natural seedlings of wild vines having superior qualities, and when their reputation became estab-

lished they were propagated and distributed, first to intimate friends and later in a commercial way.

VITIS MUNSONIANA.

Vitis munsoniana is similar to *Vitis rotundifolia* in some respects, but is different in others. It was first described by Rafinesque in 1830 as *Vitis peltata* or *Vitis floridiana*. In 1885 or 1886 specimens of the species were sent to Prof. T. V. Munson, of Denison, Tex., who described it as *V. floridiana*, but this designation was never generally accepted. Later, Simpson named the species *V. munsoniana*, the name now in common use. This species is a native of southern Florida, the Florida Keys, and the borders of the Gulf of Mexico. At its northern limits it overlaps into the territory of *V. rotundifolia*, and Hedrick speaks of it as a variation of Rotundifolia suited to subtropical conditions. The vines of *V. munsoniana* are slender, more trailing, and do not climb as high as *V. rotundifolia*. The leaves are generally smaller and the basal sinuses narrower, the marginal teeth generally less numerous, but more prominent, and the venation is also more prominent than with *V. rotundifolia*. The clusters of *V. munsoniana* contain more but smaller berries. The berries are quite persistent, usually of a shiny black color, covered with numerous reddish, brownish, or grayish dots, juicy, but with very little pulp and often of good flavor. (Pl. II, fig. 2.) There are three to four seeds, which are small and usually dark reddish brown in color. (Pl. II, fig. 1.) The vines leaf out, bloom, and fruit about the same time as *V. rotundifolia* in the same locality. All stages from fruit bud to ripe fruit may be found on the same vine late in the summer. No horticultural varieties of *V. munsoniana* have been produced, but the Department of Agriculture has now under test a number of *V. munsoniana* seedlings and hybrid seedlings of which *V. munsoniana* is one parent.

DISTRIBUTION OF MUSCADINE GRAPES.

Generally speaking the Muscadine grapes are at home in the Coastal Plains and lower Piedmont section of the southeastern and southern United States. There are several plants growing under cultivation in protected places in the vicinity of Washington, D. C. The natural northern limit is Virginia and Maryland. South of this these vines occur plentifully along the Atlantic coast to Florida, and then west along the Gulf coast to central Texas, thence northward along the Mississippi Valley to southeastern Missouri, *Vitis rotundifolia* covering almost this entire territory, but *V. munsoniana* being found only in Florida and on the borders of the Gulf of Mexico. The accompanying map (fig. 2) gives a better understanding of this distri-

bution. *V. rotundifolia* is found most abundantly in the tidewater sections and river valleys along the Atlantic coast, gradually disappearing as it approaches the Blue Ridge Mountains. The distribution of the cultivated varieties is very irregular, most of them being local. However, a few prominent varieties are cultivated throughout the entire Rotundifolia territory. Of the leading sorts the so-called Scuppernong or white varieties collectively are decidedly the most generally and extensively distributed. The other leading sorts in the order of their relative distribution are as follows: Flowers, James, Thomas, Mish, Memory, and Eden. The relatively small area in which each of these varieties is grown is due to the fact that they have not been

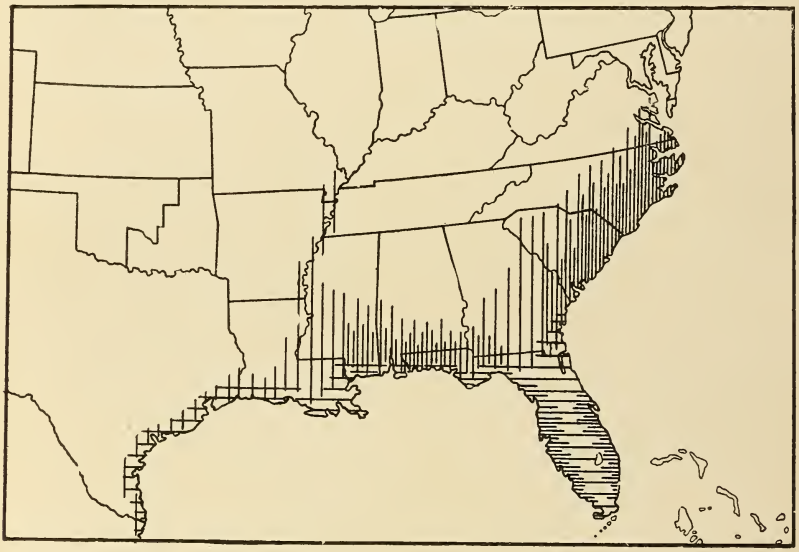


FIG. 2.—Sketch map of the southeastern portion of the United States, showing the natural distribution of Muscadine grapes. The vertical lines show the region where the Rotundifolia varieties grow and the horizontal lines the growing region of the Munsoniana varieties.

distributed throughout the Rotundifolia territory, and the investigation of the adaptability of these varieties to different conditions has not yet proceeded far enough to enable definite conclusions to be drawn. There is apparently no doubt that all the varieties mentioned can be successfully grown in other localities and to a much greater extent than at present. The accompanying map (fig. 3) shows the places at which the named varieties originated or are supposed to have originated.

It will be noted that nearly all originated in North Carolina and seven of them within a radius of 50 miles, including the towns of Marion, S. C., Whiteville, N. C., and Lumberton, N. C.

FIG 1.—TYPICAL ROTUNDIFOLIA AND MUNSONIANA SEEDS.

FIG. 2.—FRUIT AND BRANCHES OF VITIS MUNSONIANA.

FIG. 1.—A FRUITING ARM OF THE FLOWERS VINE SHOWN IN FIGURE 2, BELOW.

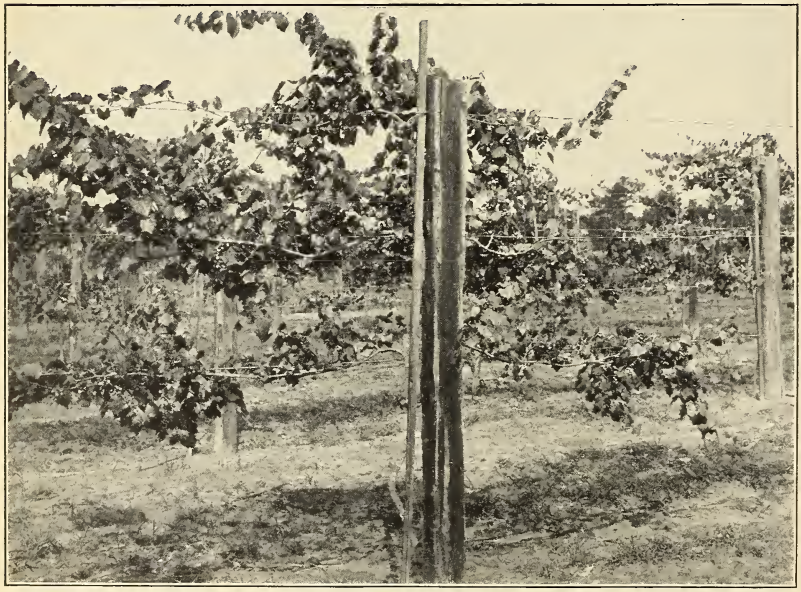


FIG. 2.—A VINE OF THE FLOWERS VARIETY TRAINED TO A 3-WIRE UPRIGHT TRELLIS IN THE COOPERATIVE EXPERIMENT VINEYARD, WILLARD, N. C.

FLORIDA.

Rotundifolia grapes have been grown for wine and domestic use in Florida since the early agricultural development of this country. Growing them for commercial purposes is generally incidental, for local markets, other fruits being thought more profitable in most sections of the State. Soon after the great freeze of the winter of 1894–95 a considerable number of vines of Rotundifolia and other grapes were planted in destroyed orange groves. The larger Rotundifolia vineyards did not generally prove profitable on account of the laws enacted restricting the sale of wines made from the grapes. Those near the larger towns yielded good returns on account of the local demand for the fruit. In fact, in the cities of Jacksonville, St. Augustine, New Smyrna, Sanford, Orlando, Maitland, Oviedo, Ocala, Gainesville, Waldo, Baldwin, Lake City, Tallahassee, De Funiak Springs, Milton, and Pensacola the Rotundifolia grape when ripe is the most important home-grown fruit in the markets, the

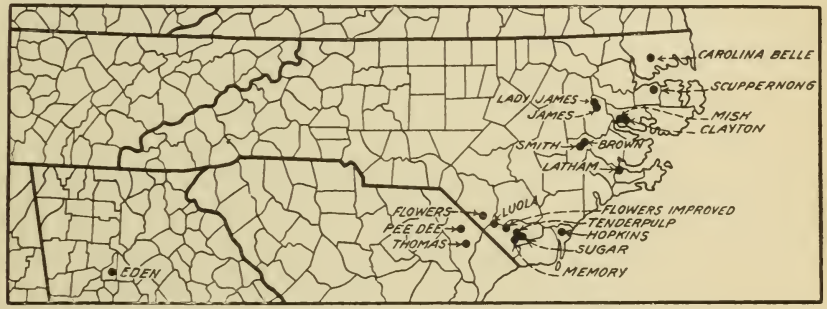


FIG. 3.—Sketch map of North Carolina and the adjacent territory, showing where the leading Rotundifolia varieties originated.

quantity of grapes incidentally seen on the market in these places when visited ranging from 1 or 2 to 20 or 30 bushels.

More than half the Rotundifolia grapes grown in Florida are of the light-colored varieties. The Flowers, Thomas, James, and Memory varieties seem to be next in order of importance after the Scuppernong. The Eden and Mish are also grown to a limited extent. In the northern part of the State wild Rotundifolia fruit is often sold in the markets. In the small towns and suburbs of the cities a great deal of the fruit is incidentally obtained from vines grown around homes, where besides yielding fruit they also serve as ornamentals, for in a subtropical climate they hold their foliage most of the year. The native grapes of Florida are largely Munsoniana and are found in great numbers in the hammock lands in the southern part of the State, along the rivers and along the Gulf in the northwestern part, through the southern central part of the State, and up through the

range of the citrus fruit. Rotundifolia grapes can, however, be successfully grown in these localities. Passing from the citrus district into the cotton belt, the wild Munsoniana vines gradually disappear and the Rotundifolia vines take their place. From Jacksonville to Pensacola the majority of the wild Muscadines are *Vitis rotundifolia*, but the fruit on them is hardly as large as on wild vines of the same species farther north. Although they can be grown to perfection there is less general interest manifested in the growing of Muscadine grapes in Florida than in Georgia and the Carolinas.

GULF AND SOUTH-CENTRAL STATES.

In the Gulf and South-Central States the soil formation and the climatic conditions are less favorable to the growing of the Muscadinia than along the coast in the South Atlantic States. Rotundifolia grapes are, however, quite generally grown in these States for both home use and local markets. Wild native vines grow plentifully and in great variety. The soils of Mississippi and the southern part of Alabama adapted to Rotundifolia compare favorably with those of Florida. The commercial vineyards formerly operated in these sections have in many cases deteriorated, owing to the fact that their crops, which were formerly made into wine, can not now be thus used on account of the local-option laws. Throughout Texas, northeastern Arkansas, southeastern Missouri, and northern Mississippi and Alabama Rotundifolia vines occur only occasionally and in limited numbers.

GEORGIA AND SOUTH CAROLINA.

In about three-fourths of Georgia and the coast section of South Carolina the conditions are well suited to Rotundifolia grapes, and they may be grown almost anywhere in these States with at least partial success. They are grown there principally for home consumption and local markets, although there are some commercial vineyards. The culture of Rotundifolia vines has gradually been extended as the population increased. The light-colored Rotundifolia varieties are mostly found on the markets. Next to these the Thomas is the most extensively grown. This variety originated in Marion County, S. C., and in the immediate vicinity of its origin the Thomas outnumbers all other varieties planted.

NORTH CAROLINA.

The Rotundifolia grape industry has reached its greatest development in North Carolina, owing principally to the fact that the people of that State have always been interested in grape growing, and the wine manufacturers have devoted a great deal of their time and

means to encouraging the industry. The early inhabitants of the State also gave some attention to selecting and placing under cultivation the best varieties of native grapes, and it was thus that the Scuppernong, James, Mish, Flowers, Memory, and several other varieties which will be described later on were introduced. The natural distribution of *Vitis rotundifolia* in North Carolina has already been referred to. Generally speaking, this species is found native only in the eastern half and in greatest abundance only in the eastern third of the State. It can, however, be grown in all but the extreme western part.

The earliest vineyards in the State were of the white type and consisted as a rule of small plantings devoted to the growing of grapes for home use and local trade. It became known early in the development of the industry in North Carolina that the white varieties produced a good sweet wine, and many grapes were made into wine for home and local consumption. The first commercial vineyard, known as the Medoc vineyard (Pl. I), located 12 miles southwest of Enfield, N. C., was started by Dr. Sidney Weller in 1835. The grapes from it have always been made into wine and its acreage has been increased from time to time until it now consists of 150 acres of the white varieties, 35 acres of the James, 25 acres of the Mish, 5 acres of the Beula, and about 5 acres of miscellaneous vines, making a total of about 210 acres. In 1847 the Tokay vineyard near Fayetteville was started by Col. W. J. Green. (Pl. V, fig. 2.) It originally consisted of 85 acres of white grapes. Since then vines of the James, Mish, and Flowers varieties have been added, bringing the total up to about 100 acres. The grapes from the Medoc and Tokay vineyards are all made into wine.

In North Carolina grape growing was recommended immediately after the Civil War to help solve existing labor problems and to replace cotton raising, which for many was then unprofitable. This resulted in many plantings, mostly small vineyards, ranging from one-fourth of an acre to 2 acres. Most of the leading varieties of Muscadine grapes were introduced at that time, each variety being extensively planted in the vicinity in which it originated. This condition continues to the present time, the leading varieties being grown more extensively than any others in the localities where they were found. It is not a case of better adaptability, but rather a case of lack of general distribution that has so far limited the wider planting of these varieties. In North Carolina this epoch of vineyard planting was followed by a period of vineyard neglect. At present, matters seem to be adjusting themselves again, and commercial vineyards are being planted, mostly in the eastern part of the State.

PROPAGATION OF MUSCADINE GRAPES.

Like grapes of other species the Muscadinia may be propagated from seeds, layers, cuttings, and grafts. They should be grown from seed only when new varieties are desired, the seedlings being usually too variable for other purposes, as many of them will be sterile or unfruitful and many of the fruiting vines will resemble the wild parents. Of 570 typical Rotundifolia seedlings grown by the Department of Agriculture and planted in the Rotundifolia experiment vineyard at Willard, N. C., 66.3 per cent have proved sterile or staminate and most of the fertile or pistillate vines have been worthless. It also appears that the majority of fruiting seedlings from light-colored Rotundifolia produce dark-colored fruit. Van Buren states that from 1860 to 1870 he raised 3,000 seedlings from the seeds of white grapes in an effort to produce white Rotundifolia, and found only one white one among them. He also says that three-fourths of all the plants proved staminate. Mr. M. T. Williams has a vineyard 7 miles southwest of Rocky Mount, N. C., which he raised from seed of white Rotundifolia. He says of it:

> Years ago I planted seeds of white Rotundifolia, expecting to get a vineyard of white grapes. Instead, I got a hundred or more varieties of grapes, only two of which were white, and these two, like all but one of the others, were inferior to the parent.

It is possible, however, to produce white seedlings or varieties. If the staminate vines are studied carefully and pollen from those having yellowish young shoots or growing tips is selected for crossing on the white-fruiting varieties which also have yellowish growing tips (dark varieties having reddish growing tips) a large proportion of and sometimes all the resulting seedlings will have yellowish growing shoots, and of these the fruiting vines will bear white fruit. This is shown conclusively by some of the experiments made by the Department of Agriculture. From crosses of a Scuppernong vine with pollen from two white staminate vines, 91 seedlings resulted, 82, or 90.1 per cent, of which produced white fruit, while 85 seedlings resulting from crosses of the same Scuppernong vine with two dark staminates having reddish growing tips produced 85, or 100 per cent, dark vines.

SEEDS.

As soon as the fruit is ripe the seeds should be separated from the pulp and stored in sand very slightly moist, not wet, and should be protected from heat, drying out, and vermin. A well-drained, fertile, light soil, which must be well prepared, should be selected for the nursery. As early in the spring as possible the seeds should be sown 1 inch apart in rows 2 feet apart and covered to a depth of

about 1 inch. When the seedlings first appear it is a good idea to shade them with brush or a lattice. As soon as they are large enough, either a stake reaching 2 feet above the ground or its equivalent should be given each plant for support. The plants may be left in the nursery until the following spring, but it is best to take up the vines in the late fall, when they should be culled and the inferior ones discarded. The good plants should be thoroughly heeled in in well-drained soil. In the spring they can be planted out for testing. Rows 8 feet apart and the vines 4 feet apart in the rows is a convenient spacing for testing. As they begin to fruit most of them will prove worthless and can be removed.

CUTTINGS.

In that portion of the Rotundifolia territory where sufficient cold weather prevails to insure a real dormant condition, cuttings are best prepared as soon as possible after the vines have become dormant, provided proper care is given to the cuttings. In the more tropical parts of Florida good results are reported with Rotundifolia cuttings made and the vines pruned shortly after the crop has been harvested. The cuttings should be from 10 to 12 inches long, made from the last season's growth, and medium-sized, short-jointed wood is preferred. The cuttings should be made with a slanting cut, close below the lower bud, and about three-quarters of an inch of wood should be left above the upper eye. It will be found advantageous to leave on the cutting a small piece of the old wood or a whorl of buds where the shoot starts from the old wood. The cuttings should be tied in bundles of convenient size, with the butts all the same way. (Fig. 4.)

FIG. 4.—A bundle of grape cuttings.

The cuttings can be planted in the nursery soon after they have been made; in fact, it is claimed by some that it is best to plant them at once. If the cuttings are to be held over winter for spring planting, the bundles should be heeled in or buried in the ground, with the top ends down and the butts covered well with 3 to 6 inches of soil. Inversion causes a callus to form at the butts, while the tops remain dormant, the cuttings being then ready to form rootlets as soon as they are planted. If heeled in with the tops up, growth often starts before sufficient roots have formed to support it. When the ground has become warm enough in the spring, plant them in soil made friable and mellow by plowing and cultivating. This can

be done by throwing out slanting trenches 2 or 3 feet apart with a plow and deepening them with a spade if necessary. The cuttings should be planted 2 to 3 inches apart, firming the ground well around their bases, being sure to set them so deep that when covered only the upper buds will project slightly. If fine soil is thrown over them they will be all the better for having this mulch. They should be kept clear of weeds and the ground frequently stirred to keep it moist and mellow, because Rotundifolia cuttings are usually difficult to root.

LAYERS.

Layering is the most common method practiced by grape growers and commercial nurserymen in propagating Rotundifolia vines. Canes may be layered at any season of the year. They are most frequently layered in midsummer, when canes of the same season's growth are used. These are bent down to the ground and covered with soil, the laterals being allowed to project above the ground. To induce the formation of roots a slight incision is sometimes made in the node, opposite the lateral. Roots will have formed by fall, and the layered canes may then be cut from the parent vine and divided, the laterals which were left usually forming the new plants. These plants should be thoroughly heeled in and held until spring. In general practice, however, the layers are not disturbed until needed in the spring, when they are taken up and planted at once.

Where vines have been trained on overhead arbors it is often impossible to get the canes down to the ground without taking down part of the arbor. In such cases the canes may be layered in boxes of soil placed upon the arbor. Where many plants are wanted, large branches may be buried, allowing the laterals to project above the ground. Commercial nurserymen grow plants especially for layering and never allow them to grow high above the ground. Each season, usually in August, the young growth made during the season is covered with soil, and during the winter all the plants produced are cut from the mother vine. This leaves nothing of the original vines except the trunks and spurs, which produce many new vigorous shoots and which in due time may again be layered.

The method of layering Euvitis vines can also be followed with Rotundifolia. This method differs from that just described in that canes of the previous year's growth starting above ground are layered. The nearer the base of the vines these canes start, the more convenient they will be for the purpose. During the previous summer, shoots starting on the vine close to the ground should be left for layering and these canes forced to grow as long as possible. In pruning the layer canes, all the well-developed buds should be left.

A shallow trench, say 2 inches deep and as long as the cane, is made and the cane fastened down into it. Each bud on the cane will usually produce a shoot, which should be made to grow upward in the open trench. When the shoots have well started, a slight incision on the node opposite should be made to induce the formation of roots, after which the trench can be filled with soil. The plants are taken up in the fall or spring, being divided by cutting the original cane between the shoots, each of which will have its own system of roots, the shoot becoming the stem of the vine. Layering by this method may be done in either the fall or the spring.

GRAFTING.

Grafting is entirely practicable, but seldom resorted to with Rotundifolia, and for this reason will not be described here.[1] Grafting may serve several useful purposes in a Rotundifolia vineyard. Worthless seedlings may be converted into standard varieties by means of grafting. A spur in the top of each pistillate vine can be grafted with a staminate scion while the vines are young enough to be bent down, thus enabling the vineyard to be planted entirely with pistillate vines instead of partly with staminate vines to serve as pollinizers. Another useful application of grafting is to promote the rooting of Rotundifolia cuttings simply by grafting roughly a piece of vine root into the butt end of the cutting. This operation is easily learned and quickly performed, and can be done indoors when weather conditions prevent outdoor work.

SOILS.

Of the land adapted to the growing of Rotundifolia grapes, the greater portion of the virgin soil is occupied with species of pines, while on that under cultivation cotton is grown. While the vines will grow on any soil suitable for cotton, ideal pine or cotton lands should not be selected for the best results. Soils adapted to growing Sea Island cotton are better. The best soils for Rotundifolia grapes are the well-drained, siliceous soils found bordering the coast and river banks throughout the Atlantic tidewater section. Different species of oaks, especially the live oak, and other hardwoods, in addition to occasional pines and other soft-wooded trees, abound in these soils in the virgin state. In parts of the coast region these lands are known as sandy ridges, in other sections as hammock and trucking soils, and sometimes as light, sandy lands. The ideal soil

[1] Those desiring information will find the methods of grafting generally practiced with grapes fully described in Farmers' Bulletin 471, entitled "Grape Propagation, Pruning, and Training," which may be had free on application to a Member of Congress or to the Secretary of Agriculture.

must contain a sufficient amount of moisture and plant food and must be something more than an ordinary light, sandy soil. It should be open and well drained but not necessarily very deep, provided the subsoil is not too heavy, for the Muscadine grapes have a shallow, spreading root system.

PREPARATION OF THE LAND.

If the Muscadine vineyard is to be planted on new ground, the growing of some cultivated crop the year previous is recommended. Since tobacco does well on new land it is a good crop for this purpose where it will succeed; otherwise corn, cotton, or any annual crop requiring cultivation, and wherever possible, a catch crop of some leguminous plant, such as cowpeas, should be grown and turned under to add humus to the soil. The three things most needed on southern farms are more humus in the soil, better drainage, and more efficient labor. When the vines are to be planted the soil should be thoroughly and deeply plowed, pulverized, and put in as good condition as possible. Muscadine grapes do not grow readily at the start and no pains should be spared either in the preparation of the soil or in planting the vines, in order to secure a good stand. It is useless to plant these varieties in wet soil.

T P T P T
P T P T P
T P T P T
P T P T P

FIG. 5.—Diagram showing the method employed in alternating permanent and temporary plantings of grapevines: *T*, Temporary; *P*, permanent.

PLANTING.

The distance apart that Rotundifolia vines should be planted depends on the variety and whether they are to be trained to overhead arbors, trellises, or some other system. The James and Flowers varieties can be successfully grown closer together than the Scuppernong, Thomas, or Eden. For an upright trellis the vines should be planted half as far apart each way as when trained on arbors.

A comparison of these two methods of training will be discussed later in this bulletin. If the vines are to be trained on overhead arbors, they are generally planted about 20 feet apart each way. If upright trellises are to be used, judging from the results of the experiments of the Department of Agriculture and from other available information, 10 feet apart each way is thought advisable. Should this prove too close as the vines approach full size, alternate vines in each row may be removed. In this case half the vines will be only temporary and should be removed as indicated in the accompanying diagram (fig. 5), in which the letter "T" indicates temporary vines and "P" permanent vines. In this manner at least one-half of a crop and two full crops can be obtained from the temporary vines before

the permanent vines will need the full space. This would certainly more than pay for the expense of growing the temporary vines.

Bulletin 132 of the South Carolina Agricultural Experiment Station recommends that Rotundifolia for training on upright trellises be planted in rows 15 feet apart and the vines 30 feet apart in the rows. So far, the observation of the writers and the results of experiments indicate that these distances are too great. However, this is still an open question and until further experimental demonstrations can be made vineyardists will have to depend on their own judgment. When planted 10 by 10 feet, 435 vines will be required to plant an acre, and when 20 by 20 feet, 108 vines will be necessary for the same area. The methods of laying out and staking the land for planting

FIG. 6.—Rotundifolia grapevines as received for planting.

have been described in so many publications that they need not be repeated here.

Planting can be done either in the spring or in the fall. It is generally done in the spring, about the time the buds burst and growth starts. When taking the plants from the nursery or where they have been heeled in, it is a good plan to place them in a wheelbarrow or cart with moist dirt or sand about the roots or to cover them with wet burlap in order to prevent their drying out. It is an advantage for more than one person to do the work of planting. Before planting, all diseased or broken roots should be cut off and the roots foreshortened if necessary. On young plants the top should be shortened to the required length, and where the plants are more than 1 year old the top should be cut back to one short spur. (Figs. 6 and 7.) The hole should be dug wide enough to prevent crowding the roots

and so deep that when the vine is planted only the top bud will be slightly above the ground. This will usually require a hole about 15 inches deep and 12 inches wide. After the hole has been dug, a little of the good, loose surface soil should be thrown into the bottom and the vine placed in position. Then more surface soil should be thrown in and worked well between the roots of the plant. The ground should be especially well firmed around the roots and the whole mass of soil firmed as the hole is filled. When planted only the top bud of the vine should be slightly above ground. Great care should be taken in planting in order to secure good results. Three things should be particularly observed:

(1) Care should be taken to keep the roots of the plants from drying out;

(2) The roots and tops of plants should be pruned properly before planting; and

(3) The soil should be carefully firmed around the roots.

Devices are sometimes used in planting to show the exact position of the vine. This should not be necessary if the land has been cor-

FIG. 7.—Rotundifolia grapevines pruned ready for planting.

rectly laid out and staked and care taken to place each vine in proper position in the hole.

CULTIVATION.

The proper methods of cultivating Rotundifolia vineyards are disputed points. Some claim that because the vines have a shallow, spreading root system (fig. 8) cultivation will disturb and reduce the roots and seriously affect the vitality of the plants. Others claim that the roots are much benefited by cultivation. This question is being given very careful study in the work of the Department of Agriculture. Observation shows that almost without exception the best yields are obtained from cultivated vineyards and that the best and most successful growers are cultivating their vines. By cultivation is meant a shallow stirring of the surface soil and not deep plowing. In locations where the water table is close to the surface or where there is a stratum of hardpan clay directly under the top soil, the roots also are nearest the surface. In deeper and better aerated

soils the roots strike deeper. Where cultivation is practiced from the beginning, Rotundifolia roots will not grow so close to the surface. A dust mulch on the surface appears not to injure the roots and benefits the plant. This hypothesis has been followed in the Rotundifolia experiment vineyard of the Department of Agriculture, at Willard, N. C., and the results have thus far been satisfactory. The best information obtainable to date suggests the following course in regard to cultivation and cover crops:

(1) Care should be taken to drain the land.

(2) In the spring, before planting, the land should be well and

FIG. 8.—Rotundifolia grapevine, showing shallow, spreading root system.

deeply plowed. Following in the surface plow furrows with a subsoiler will prove most advantageous.

(3) The year the vines are planted, truck crops, strawberries, cotton, tobacco, or similar crops can be grown, truck crops being much preferred. Peanuts are also an ideal cover crop, since they require cultivation, add humus and nitrogen to the soil, and produce a paying crop.

At least 3 feet should be left vacant on each side of the vine rows, the vines being treated as a hoed crop. If truck crops, such as potatoes, early cabbage, beans, or peas, are planted, it is also possible

to follow with a crop of cowpeas planted late in the summer to be turned under the following spring.

The vineyard may be again intercropped during the second year. If, however, the vines are trained to upright trellises and the rows are only 10 feet apart, only two rows of truck or other crops can be planted. A leguminous catch crop may again be planted.

After the second year the vines should be allowed full possession of the land and the soil should be given frequent, shallow, clean culture throughout the first part of the season and a leguminous catch crop planted in the latter part of the season for turning under. Grain crops, especially oats, should never be planted in a properly located Muscadine vineyard.

In the cooperative experiment vineyard at Willard, N. C., bur clover is proving a great success both as a cover and as a green-manure crop. When planted in the early fall of the first year, bur clover will produce a winter cover crop and ripen its seeds the following May. The dead tops can then be raked away from the spiral seed pods which have ripened and fallen to the ground. The seeds may then be brushed into piles and bagged. During the past season (1911) the North Carolina State Department of Agriculture harvested over 100 bushels of seed (in the bur) from about 1 acre of the experiment vineyard. The surplus seed was sold to a large vineyard company for $1.50 a bushel. In this way a vineyard on upright trellises may be made to yield a very profitable annual catch crop. After the bur clover seed is harvested, the ground should be thoroughly cultivated in order to turn under the remaining bur clover pods for reseeding. From about July 1 to July 10, three rows of cowpeas may be planted between the vine rows if the latter are 10 feet apart, and when the cowpeas die in the fall the bur clover will be ready to take possession of the land.

The few small roots cut by cultivation will not injure the vines; they will rather be induced to yield more fruit. If the surface soil is shallow it will probably be best to use cutaway or disk harrows in cultivating. The Muscadine vines, being naturally shallow feeders, should be induced to send down their roots as much as possible, which can be done by stirring the surface regularly. Cultivation should be level at all times.

The foregoing observations made in the cooperative experiment vineyard and in existing commercial vineyards are presented as suggestions only and are not to be considered as final conclusions.

FERTILIZATION.

Very little definite information is available relative to the best fertilizers for Rotundifolia grapes, which respond readily to proper fertilizer treatment. Nearly all soils suitable for these vines lack

humus; therefore, where good stable manure is available, applications of not to exceed 6 tons to the acre will prove useful. Where manure is scarce, the bulk of the necessary organic matter may be supplied by growing and turning under leguminous crops, but commercial fertilizers will be needed in most cases in addition to these green-manure crops. For this purpose a general fertilizer containing nitrogen, phosphorus, and potassium, in which most soils are found deficient, will be best. The kind and quantity of fertilizer needed will depend largely on the character of the soil. Sandy soils usually require heavier fertilization than sandy loams, which in turn need more than red clays. Commercial fertilizers are not as

FIG. 9.—Vines trained by the multiple cross-wire or overhead system.

important as the growing and turning under of cover or green-manure crops, but both are needed to obtain the best results.

PRUNING AND TRAINING.

The system of training followed in the growing of Rotundifolia vines for commercial purposes has been and still is almost exclusively on overhead arbors. (Fig. 9.)

When planted in sufficient number to be called a vineyard the vines are usually set 10 by 20, 15 by 15, or 20 by 20 feet apart.

In following the overhead system of training, a durable post reaching 7 feet above the ground is planted at each vine. Rows of well-braced posts at the ends of the rows on all four sides are set at

the boundaries of the vineyard. From the tops of these posts a No. 10 galvanized wire is run along the tops of the inside posts in each row in both directions as a governor wire. No. 14 wires, 2 feet apart, are run parallel with the governor wires until in this manner the entire area has been regularly covered, in a rectangular criss-cross manner. Some growers construct the arbors entirely of wood, using slats instead of wires for this purpose. (Pl. VI, fig. 1.)

In training the vines to the overhead-arbor system a single trunk should be caused to grow from the ground alongside the post, to which it should be tied, and after it has reached the top it should be

FIG. 10.—A grapevine 37 years old, severely pruned.

pinched in or cut back in order to force it to throw out shoots, which are allowed to grow and spread over the arbor. After this the prevailing practice is to do no more pruning, under the supposition that the vines naturally prune themselves and that radical pruning or cutting back will kill them.

In order to determine the correctness or incorrectness of the growers' theories regarding pruning, a number of experiments were started in 1908 and have been continued for three seasons in commercial Rotundifolia vineyards in North Carolina and Florida. The investigations were designed to cover all phases of pruning from the

mildest to the severest treatments, such as simple foreshortening of the branches, mild thinning out of the branches, regular renewal, cutting back entire tops and growing new ones, removing all diseased parts from badly diseased vines, restoring the vines to vigor, etc.

Figure 10 shows a large 37-year-old vine just pruned that was badly diseased, from which all diseased parts have been removed and the entire top severely thinned out and cut back. The vine has since become healthy, vigorous, and productive.

The pruning experiments of the Department of Agriculture show conclusively that not only will Rotundifolia vines stand pruning, but

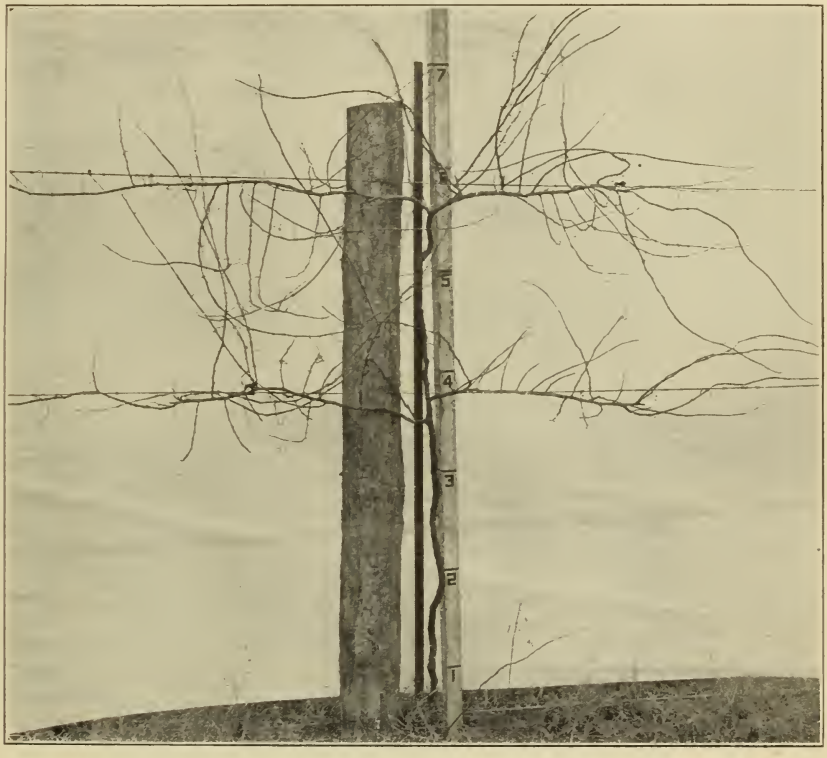


FIG. 11.—Unpruned grapevine trained by the 4-arm renewal system.

in order to have permanently healthy vines they must be systematically and regularly pruned. Early observations and study showed that the training systems, if systems they may be called, practiced by commercial growers were crude and wasteful at best, yielding only partial returns. Therefore, a series of plantings consisting of regular checks of the leading commercial varieties was made in 1907 in the cooperative experiment vineyard at Willard, N. C., for the purpose of making varietal studies, as well as to investigate the

effects of a number of different pruning and training systems with a view of determining those most suitable for Rotundifolia vines. In addition to the overhead cross-wire system (fig. 9) such upright systems as the fan and the 2-arm, 4-arm, 6-arm, etc., renewal systems are included in the work. Figures 11 and 12 show a vine, before and after pruning, respectively, trained to the 4-arm renewal system, and

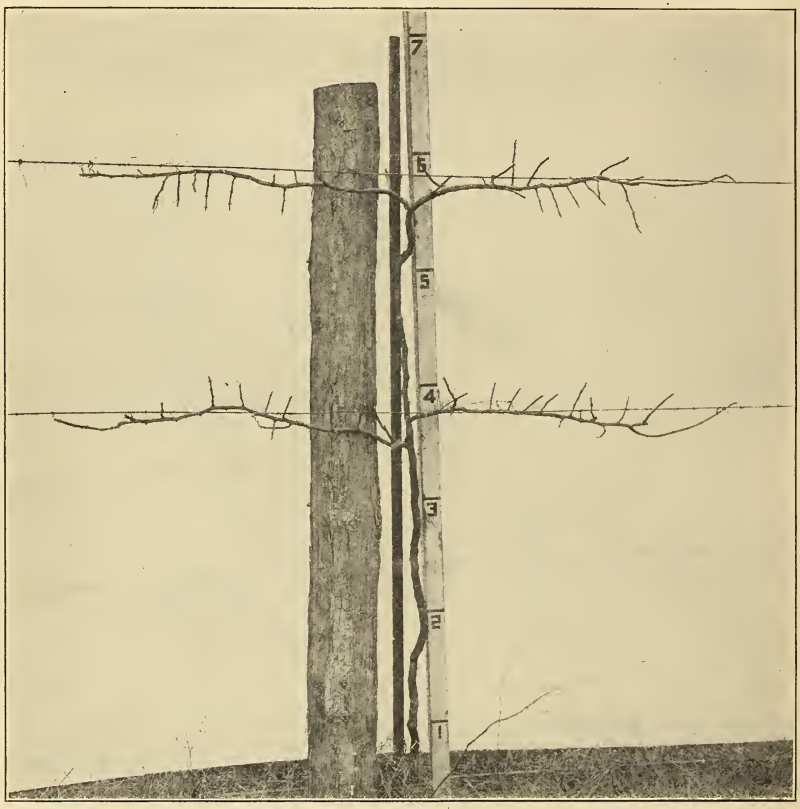


FIG. 12.—Pruned grapevine trained by the 4-arm renewal system.

figures 13 and 14 one also before and after pruning, trained to the 6-arm renewal system.

Plate III, figures 1 and 2, shows a Flowers vine trained to the 6-arm renewal system and a portion of one of the arms with fruit on it. The pruning and training experiments have so far yielded results beyond expectations, and lead to the belief that vines trained by the upright systems not only bear paying crops at least a year earlier than those trained by the overhead system, but also bear larger crops of much better fruit which ripens more evenly. In addition, the vines occupy only about one-half the space required by the

FIG. 1.—ROTUNDIFOLIA GRAPES IN CARRIERS FOR SHIPMENT.

FIG. 2.—ROTUNDIFOLIA GRAPES IN BASKETS FOR SHIPMENT.

FIG. 3.—ROTUNDIFOLIA GRAPES IN BERRY BOXES FOR SHIPMENT.

FIG. 4.—JARRED GRAPES IN BARRELS AND FAN BLOWER FOR CLEANING THEM.

FIG. 1.—GENERAL VIEW OF SOUTHERN PINES VINEYARD, SOUTHERN PINES, N. C.

FIG. 2.—GENERAL VIEW OF TOKAY VINEYARD, FAYETTEVILLE, N. C.

FIG. 3.—REMAINS OF THE STOVER VINEYARD, COLUMBIA, S. C.

FIG. 4.—AN OLD WINE PRESS ON THE CANNON FARM, CHAPEL HILL, N. C.

overhead-arbor system, the fruit can be harvested more cheaply and to better advantage, and insect enemies and diseases of the vine and fruit can be more easily controlled on them.

HARVESTING AND HANDLING.

Rotundifolia vines have been almost entirely grown on overhead arbors in the past, the fruit being made into wine, and under such conditions the general practice of jarring the grapes from the vines

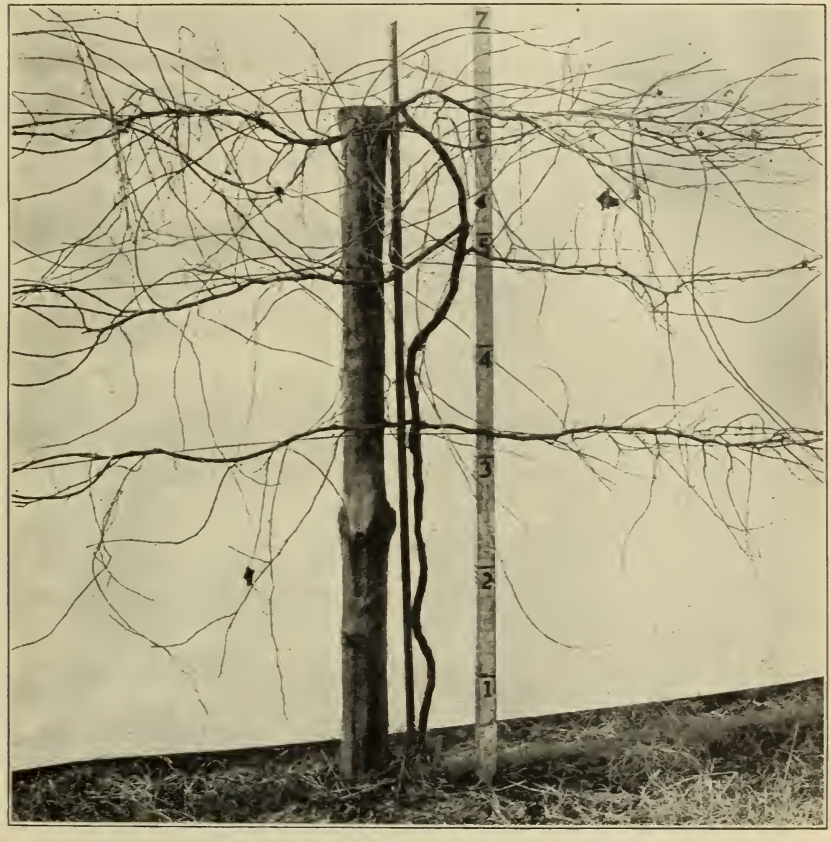


FIG. 13.—Unpruned grapevine trained by the 6-arm renewal system.

is perhaps the most practical method of harvesting. If the vines are trained to upright trellises or if the fruit is intended for shipping or table use the grapes should be picked by hand in order to be sound and clean. On account of the presence of leaves, twigs, etc., mixed with the grapes jarred from the vines, wine and grape-juice manufacturers will pay 5 to 15 cents a bushel more for hand-picked grapes. The growers who make a practice of hand picking claim that the work can be done at practically no greater expense than is necessary to

shake off and clean a crop, and the increased price obtained for the fruit will more than pay the difference.

A description of the harvesting of Rotundifolia grapes by the jarring method will be interesting to those not familiar with it. (Pl. I.) Poles are attached to sheets of canvas measuring 6 by 12 feet and having leather handles. A man is placed at each end of these sheets and four men with two sheets work together. The wide sides of the two sheets are brought close together under each vine, with the trunk

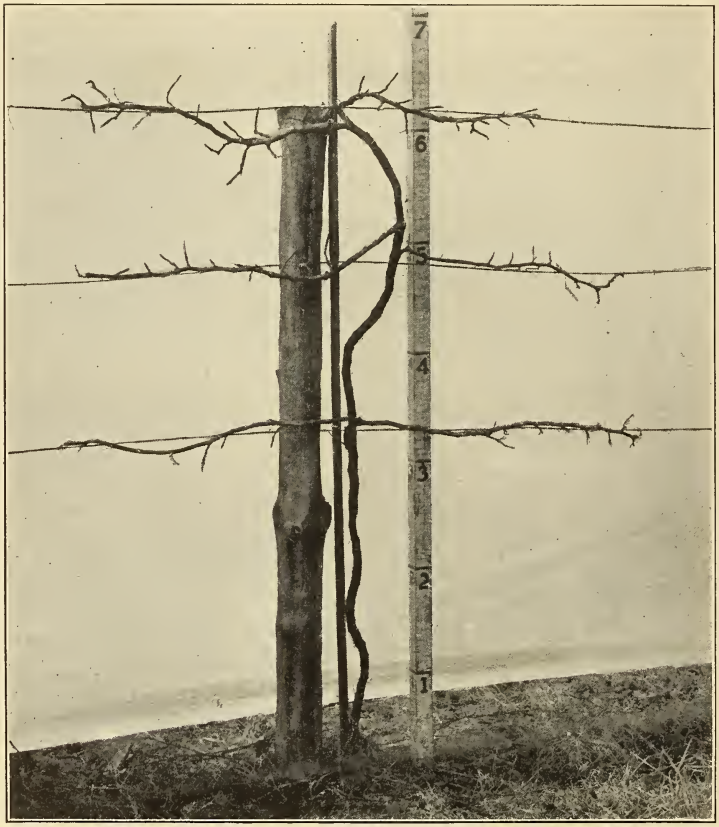


FIG. 14.—Pruned grapevine trained by the 6-arm renewal system.

of the vine in the middle. The vines are then jarred, the berries falling into the sheets. Those not caught by the sheets or that have fallen to the ground by the shaking of the trellis when the fruit of the adjoining vines was harvested, etc., and which are usually of the best quality, are picked up by hand. The writers are informed that it costs approximately 15 cents a bushel to harvest the fruit on the ground and 12 cents to harvest that which falls on the sheets.

The fruit is put in boxes or barrels, and if the quantity is not large the leaves, sticks, etc., which become mixed with the fruit are removed by hand. If there is a considerable quantity of fruit some mechanical means, such as ordinary grain fan mills, are used to clean it. (Pl. IV, fig. 4.) After cleaning, the fruit is hauled or shipped to the winery. In wineries with modern equipment there are blowers which thoroughly clean the fruit. These are located near the end of the elevators that carry the fruit to the crusher.

A common and very objectionable practice followed in harvesting Rotundifolia grapes, especially by the jarring method, is that of gathering the fruit all at once, whereas there should be at least three periods of harvesting. When harvested at one time the best quality of fruit ripens, falls to the ground, and is lost before the harvest has commenced and the last part of the crop is thrashed from the vines in a half-ripe condition along with the ripe fruit. In this manner not only is the first and best fruit entirely lost, but the harvested fruit is inferior in quality, which necessarily results in a poor product from the entire yield.

YIELDS AND RETURNS.

Great variations occur in the yields from Rotundifolia vines. At times there are record-breaking yields and, again, small yields are reported, the small yields resulting from black-rot, coulure, wet weather, self-sterility, lack of cultivation, fertilization, etc., lack of pruning, age of vines, and various other causes. In spite of this, Rotundifolia vines are said to be among the safest and most prolific of fruit-bearing plants. (Pl. III, fig. 2.) While in one of the largest Rotundifolia vineyards there has been only a partial crop during the last three years, owing to various causes, another grower reports a yield of 177 bushels of grapes from 4-year-old James vines, in addition to a bale of cotton to the acre. A Florida grower estimated his crop of white Rotundifolia and Thomas grapes for the season of 1911 at 280 bushels to the acre. An average yield of 27 bushels an acre from 4-year-old vines, 100 bushels from 5-year-old vines, and 150 bushels to the acre when the vines are in full bearing should be obtained.

The prices paid for Rotundifolia grapes depend on the season, the quality of fruit, and the market. In years when the crop is short better prices are usually paid than when there is a heavy crop. Aside from the grapes sold and shipped to wineries, grapes as a rule sell for more in the cities and larger towns than in smaller places, the local demand being somewhat in proportion to the population. In such localities fruit of good quality will bring a much better price than inferior fruit. Hand-picked fruit in half-bushel peach baskets or in berry boxes usually brings from $1 to $2 per bushel. Grapes har-

vested by jarring are usually sent to the wineries and bring an average of 75 cents per bushel of 60 pounds. The highest price paid for this quality of fruit was reached in 1910, when $2.25 per bushel (f. o. b. shipping point) was paid for white Rotundifolia.

In many localities certain growers have built up quite a reputation for themselves on choice, hand-picked fruit, which they ship to special customers in distant markets. (Pl. IV, figs. 1, 2, and 3.) For this purpose the James variety is usually grown because the berries adhere well and are of good size and flavor. Several growers ship as far north as New York and Boston, getting from $2 to $2.50 gross per bushel crate. In shipping, three styles of carriers are used—the 24-box strawberry crate, the 6-basket peach crate, and the 8-pound grape basket. More attention should be given to this phase of the industry. The varieties best suited for shipping are the James, Memory, Flowers, and Mish.

In the fall of 1910 shipments of the James, Thomas, and Eden varieties were sent from the Rotundifolia experiment vineyard at Willard, N. C., to Washington, D. C., part of the consignment being in strawberry boxes and the remainder in bushel baskets. No important difference could be noted in the two lots on their arrival at Washington. The James variety arrived in perfect condition in both packages; of the Eden 30 per cent and of the Thomas 35 per cent had shelled. More extensive experiments along this line are contemplated.

RELATION OF WINE MAKING TO THE ROTUNDIFOLIA-GRAPE INDUSTRY.

The growth of the Rotundifolia-grape industry is at present dependent on the wine industry of the section where the fruit is produced. In fact, the bulk of the grapes now produced is used for wine making. Wine from Rotundifolia grapes has been made in an amateur way along the South Atlantic coast region for many years and probably ever since the country was first settled. Large vineyards have been successfully operated for a number of years, but with the exception of the Medoc vineyard, in which the first plantings were made in 1835, and the Tokay vineyard, started in 1847, the early vineyards have been allowed to deteriorate or have been destroyed in recent years. The old Cannon vineyard, at Chapel Hill, N. C. (Pl. V, fig. 4), and the Stover vineyard at Columbia, S. C. (Pl. V, fig. 3) are remains of such vineyards. Each of these originally consisted of about 50 acres and was operated as early as 1850 or 1860. The Stover vineyard has been allowed to go down entirely while only about 30 small arbors of the Cannon vineyard are left. The Stover place was operated by Col. Stover, a German, and his wines are said to have been

very popular in the local markets. The remains of another old vineyard, now owned by Daniel Pratt, are reported to exist at Prattville, 14 miles northwest of Montgomery, Ala. The Petigrew vineyards, on Lake Scuppernong, in North Carolina, planted by Rev. Charles Petigrew in 1774, were operated prior to 1850. The Rotundifolia wineries of note at present are located at Norfolk, Va., and Wilmington, N. C. These plants have modern equipment. The growers appear to be dependent on these establishments, or at least will be in the near future, to handle their grapes, and there seems to be no doubt that these firms will be able to use all the grapes offered them for some years to come.

TABLE I.—*Brix readings and acid tests of Muscadine grapes.*

Location of vineyard.	Variety.	Date (1910).	Brix readings corrected to 17.5° C.	Acid as tartaric (grams per 100 c. c.) in—		Condition.
				Free-run juice.	Juice after grinding.	
Cooperative experiment vineyard, Willard, N. C.	James	Sept. 1	11.9	0.397	0.75	Not fully ripe.
Do	Eden	...do	11.78	.99	1.07	Do.
Do	Thomas	...do	15.2	.43	.58	Do.
Do	Scuppernong	...do	14.12	.61	.79	Do.
Ronnoc grove, New Smyrna, Fla.	Memory	Sept. 8	15.36	.465	.66	Good.
Hinkle vineyard, Maitland, Fla.	Thomas	Sept. 10	19.02	.09	.34	Overripe.
Do	Scuppernong	...do	16.0	.54	.72	Do.
L. O. Booher, Ocala, Fla	Munsoniana	Sept. 11	14.5	1.31	1.31	Good.
A. W. Curry, Winfield, Fla	Scuppernong	Sept. 13	16.18	.25	.41	Do.
J. J. Powers, Welton, Fla	Flowers	...do	15.28	.53	.62	Do.
M. Foley, Aberdeen, N. C	Seedling	Sept. 21	16.16	.697	.787	Do.
Do	James	...do	14.06	.33	.585	Do.
Southern Pines Vineyard Co., Southern Pines, N. C.	Scuppernong	...do	17.06	.607	.817	Do.
Tokay vineyard, Fayetteville, N. C.	Mish	Sept. 22	12.55	.26	.39	Do.
Do	Flowers	...do	13.56	.607	.68	Do.
J. S. Breece, Fayetteville, N. C.	James	...do	15.13	.24	.435	Do.
M. T. Williams, Rocky Mount, N. C.	Mish	Sept. 29	19.04	.51	.63	Do.
Do	James (large)	...do	14.02	.735	.967	Do.
R. R. Bulluck, Enfield, N. C	James	Oct. 1	13.77	.....	.....	Do.
Medoc vineyard, Enfield, N. C.	Beula	...do	13.67	.....	.....	Do.
Do	Mish	...do	13.67	.....	.....	Do.
Do	James	...do	18.17	.....	.....	Do.
G. W. Lennon, Whiteville, N. C.	Lennon	Oct. 6	13.93	.276	.397	Do.
Do	George	...do	15.56	.375	.337	Do.
J. L. Memory, Whiteville, N. C.	Thomas	...do	15.36	.375	.54	Do.
H. W. Whitehurst, Newbern, N. C.	Mish	...do	17.16	.39	.465	Do.
Do	Scuppernong	...do	16.06	.48	.72	Do.
Do	James	...do	13.15	.177	.39	Do.
J. Ivy Brown, Kinston, N. C.	Brown	Oct. 9	14.02	.607	.727	Do.
Ellen Griffin, Washington, N. C.	Clayton	...do	14.12	.54	.68	Do.
Mrs. J. H. Willis, Washington, N. C.	Mish	...do	16.93	.307	.435	Do.
Charles James, Grindool, N. C.	Lady James	Oct. 10	14.87	.38	.495	Do.

The wine made from Rotundifolia grapes is very distinct in flavor and other characteristics, and on that account a special trade for it must be developed. Those accustomed to the flavor are very partial

to this wine. The skins of all Rotundifolia grapes are very high in acid, have a pronounced acrid flavor, and contain almost the entire coloring values of the dark varieties. Tables I and II, giving Brix readings and acid content of the Muscadine varieties, will indicate quite closely the juice and wine values of the commercial Rotundifolia varieties now under culture.

The Brix readings were corrected to 17.5° C. Acid was determined by titrating 10 c. c. portions of the juice with tenth-normal alkali, using litmus solution on a spot plate as an indicator, and expressed as grams per 100 c. c. of acid as tartaric. The Brix spindle readings indicate with considerable accuracy the sugar contents. These and the acid determinations are of unheated juice of freshly pressed, also freshly ground fruit, which in each instance was first strained through muslin.

UNFERMENTED GRAPE JUICE.

A very palatable unfermented juice for home use can be made from Rotundifolia grapes, though the experiments thus far made show that much better results must be accomplished before such juices can compete with those made for commercial purposes from the Euvitis varieties. The unfermented Rotundifolia juices, although quite pleasant when fresh or as they run from the crusher, not only seem devoid of fruity flavor after pasteurizing, but in the juice of some varieties a foreign, insipid, somewhat disagreeable flavor develops. The juice kept from fermenting by holding in cold storage also appears devoid of fruity flavor. When made and kept, either by cold storage or pasteurization, the addition of sugar brings out the fruity flavor. It is more than likely that by evaporation a very palatable sirup could also be made from Rotundifolia grapes.

Farmers' Bulletin 175, entitled "Home Manufacture and Use of Unfermented Grape Juice," which can be had free on application to a Member of Congress or to the Secretary of Agriculture, explains fully how to make and keep unfermented grape juice.

OTHER USES OF MUSCADINE GRAPES.

As a fruit to be consumed fresh, Rotundifolia grapes are much relished, especially if eaten at the time they are picked from the vine. The flavor deteriorates quite rapidly after picking.

As a result of the very crude growing and pruning methods at present practiced by the growers, the berries of the clusters of some varieties ripen unevenly and the individual berries shell from the stem as they ripen. This not only detracts from their use as a shipping fruit, but the juice exuding from the skins of the berries makes them sticky and unsightly and they soon ferment and spoil. The

large seeds are also objectionable, although this is of minor importance. The very thick, tough skin of some varieties also disqualifies them for the table and lessens their value for other purposes.

All the Rotundifolia varieties make most excellent jellies and preserves. For making preserves, the pulp should be separated from the skins, the seeds extracted, and after the skins have been cooked tender the pulp should be put with them again and the making of the preserves completed.

The fresh hulls when dried will keep almost indefinitely. These and the canned grapes are said to make fine pies. A delightful catchup is made from the fresh grapes.

There are a number of other purposes for which these grapes are used, but it is impossible to mention or describe these within the limits of this bulletin.

There are very marked differences in the varieties relative to the color, size, and flavor of the fruit, the thickness and toughness of the skin, the size of the seed, the texture and size of the pulp, their juiciness, and their sugar and acid content, so that by selecting and improving the varieties for special purposes and adjusting them to soil conditions, as well as by giving them better methods of culture and training, no doubt their value for various purposes can be much enhanced.

BRIX READINGS AND ACID CONTENT OF MUSCADINE GRAPES.

During the fall of 1910 investigations were started to ascertain the average Brix readings and acid content of the different Muscadine varieties produced under like conditions, as well as in the same varieties when grown in different localities and environment. Tables II and III present the results obtained during one season only. On account of unavoidable delays in carrying out the field work of the season many varieties had ripened in certain places before the analyses were made and could not be tested. The results obtained give a fair idea of the average Brix reading and acid content of the different varieties tested. Each figure in Table II is an average of three determinations. With a few exceptions, as noted in Table I, only fully ripe grapes were used. Separate determinations were made of the acid content of the free-run juice and of the total juice that could be obtained after grinding the grapes in an ordinary meat grinder. There is practically no difference in the Brix readings of the free-run and the total juice.

TABLE II.—*Average Brix readings and acid content of varieties of Rotundifolia grapes from all tests.*

Variety or species.	Number of tests.	Average Brix readings of juices (corrected to 17.5° C.)	Average acid (grams per 100 c. c.) in—	
			Free-run juice.	Juice after grinding.
James	7	13.877	0.375	0.625
Thomas	3	16.58	.298	.486
Scuppernong	5	15.88	.498	.691
Flowers	2	14.42	.568	.65
Mish	5	16.77	.466	.48
Eden	1	11.78	.99	1.07
Memory	1	15.36	.465	.65
Munsoniana	1	14.5	1.31	1.31
Seedling from Foley	1	16.16	.697	.787
Beula	1	13.67	.....	.....
Lennon	1	13.93	.276	.397
George	1	15.56	.27	.337
Brown	1	14.02	.607	.727
Clayton Improved	1	14.12	.54	.68
Lady James	1	14.87	.38	.495

TABLE III.—*Comparison of the seven leading varieties of Muscadine grapes in accordance with their rank in Brix readings and acid content.*

Rank.	Brix readings.	Acid in free-run juice.	Acid in total juice after grinding.
1	Mish	Eden	Eden.
2	Thomas	Flowers	Scuppernong.
3	Scuppernong	Scuppernong	Memory.
4	Memory	Mish	Flowers.
5	Flowers	Memory	James.
6	James	James	Thomas.
7	Eden	Thomas	Mish.

INSECTS AND DISEASES.

One of the chief advantages of the Muscadine grapes is their relative freedom from disease and insect injury. So far no insect injury has been noticed, other than an occasional slight damage from one of the flea beetles (*Haltica chalybea*, Ill.). Black-rot (*Guignardia bidwellii*) is known to have done serious injury in several of the larger vineyards, and the more progressive growers are resorting to spraying in order to combat this disease. Black-rot attacks both the leaves and the bloom clusters. Its attacks on the leaves produce brick-red spots in which many tiny black dots are found. These dots are the fruiting bodies of the fungus and each produces many spores, which are capable of causing additional disease. The fungus kills the leaves or reduces their food-elaborating surface, which causes a weakening of the vine and consequent reduction of the crop in the following years.

The black-rot attacks the bloom clusters as they are about to open, killing the individual buds and thereby reducing the size of the crop.

After the fruit has once set it appears to be rarely attacked by black-rot and in this particular Muscadine grapes differ from other species of which both the green and ripening berries are attacked. It is beyond the province of this bulletin to enter into a full discussion of the black-rot fungus, as this involves a special pathological investigation. Persons interested should consult the publications of the Department of Agriculture dealing with grape diseases.[1]

RESEARCHES IN SELF-FERTILITY, STERILITY, AND BREEDING.

Breeding and pollinating experiments are being conducted with a view of producing more desirable varieties and also as a means of studying the relative fertility of pollen and the receptiveness of the pistils of both the Rotundifolia and Munsoniana varieties. While these investigations are far from complete, sufficient progress has been made to warrant a few statements at this time.

The breeding experiments have in view improvement along the following general lines: (1) Better adherence of berry to cluster, (2) increased size of cluster, (3) higher sugar content, (4) decreased acid content, (5) pulp improvement, (6) decreased size of seed, (7) thinner skin, (8) more uniform ripening, and (9) self-fertility.

These are high ideals which if accomplished at all will most likely require years of research. The fact that the present commercial varieties are apparently self-sterile increases the complexity of the problem. The sterility study was started in 1907 to meet a demand for information along this line. The Muscadine vines were known to be of two types as regards the character of their bloom. Over 60 per cent of Muscadinia seedlings produce staminate, or male, blooms, the remainder producing flowers having both stamens and pistils in which the female organs are capable of producing normal fruit if fertilized. The stamens of this type of flower are, however, short and recurved. The question raised, therefore, was whether the pollen from stamens of this type of flower can fertilize the pistils of the same flower or whether it is necessary to obtain pollen from wild staminate vines.

The experiments in testing the self-fertility of varieties were started in 1907 at eight different places in Florida, South Carolina, and North Carolina by covering the blossoms of 11 varieties with bags to exclude foreign pollen. Microscopical tests of Muscadinia pollen were begun, similar to those made of Euvitis varieties by Mr. N. O.

[1] Quaintance, A. L., and Shear, C. L. Insect and fungous enemies of the grape east of the Rocky Mountains. Farmers' Bulletin 284, U. S. Dept. of Agriculture. 1907.

Shear, C. L., Miles, G. F., and Hawkins, L. A. The control of black-rot of the grape. Bulletin 155, Bureau of Plant Industry, U. S. Dept. of Agriculture. 1909.

Booth, of the New York State Agricultural Experiment Station at Geneva, N. Y.[1] A limited number of germination tests of pollen in 20 per cent (standard) sugar solution were also made, while 775 pollinating operations for breeding purposes yielded additional information. Careful field studies have been made from the beginning in Florida, Georgia, South Carolina, North Carolina, and Virginia on the influence of male vines and other environmental factors on the size of the crop, of the structure of the flowers of cultivated and wild vines, and of the proportion of flowers setting fruit. In 1911 the pollinating experiments were confined to New Smyrna, Ocala (Pl. VI., fig. 1), and Maitland, Fla., and Willard and Wilmington, N. C. During the season 106 Rotundifolia and Munsoniana vines of 14 varieties were used and 2,431 clusters, representing about 68,300 blooms, were operated on, and simultaneous microscopic tests and pollen germination tests in sugar solution were made as checks on the field work. The work is, of course, not yet completed. The following are, however, some results and conclusions reached:

(1) *Vitis munsoniana* varieties naturally set a higher percentage of fruit than those of *V. rotundifolia*.

(2) Weather conditions greatly influence the setting of fruit, dry, sunny weather at blooming time favoring it, while cool, showery weather hinders it by washing off the pollen, preventing the work of insects and promoting the spread of black-rot.

(3) Artificial hand cross-pollination in bags with pollen from male vines materially increases the setting of fruit, and through the daily hand-pollinating of unbagged blossoms the setting of fruit may be still further increased. In 1911 very accurate estimates made of the natural setting of fruit in North Carolina and Florida showed this to be 10.6 per cent of the total blooms, or 14.41 per cent below the maximum, resulting from the combined natural and artificial pollination under the most favorable circumstances.

(4) All tests so far made show that the Scuppernong, James, Thomas, Flowers, Mish, Eden, Memory, and Hopkins varieties are practically incapable of fertilizing themselves or each other.

(5) Muscadine vines with perfect flowers can be produced. Two vines of this character, grown by the writers from seed, are now fruiting in the cooperative experiment vineyard at Willard, N. C. One of these is a white Rotundifolia seedling, the other a dark-fruiting cross between the Eden variety and a staminate vine. Their dried pollen resembles that of staminate Rotundifolia and germinates in sugar solution. They set fruit under natural conditions, and other varieties have been successfully fertilized with

[1] N. O. Booth. Investigations concerning the self-fertility of the grape, 1900–1902. Bulletin 224, New York Agricultural Experiment Station, 1902, p. 291–302.

FIG. 1.—TYPICAL ROTUNDIFOLIA GRAPE ARBOR. THE BAGS ON THE VINE INCLOSE CLUSTERS USED IN POLLINATING EXPERIMENTS.

FIG. 2.—SEEDLINGS IN BREEDING BLOCK IN THE COOPERATIVE EXPERIMENT VINEYARD, WILLARD, N. C.

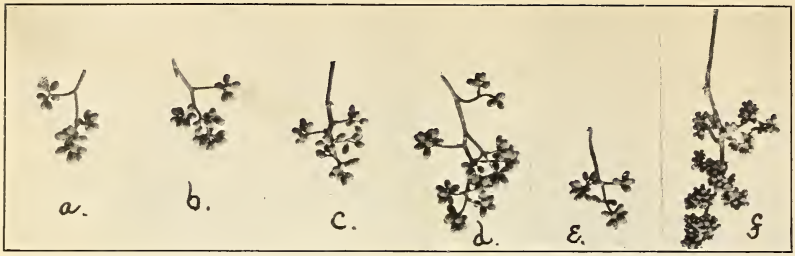


FIG. 1.—TYPICAL ROTUNDIFOLIA CLUSTERS BEFORE BLOOMING: *a*, JAMES; *b*, THOMAS; *c*, FLOWERS; *d*, EDEN; *e*, SCUPPERNONG; *f*, STAMINATE.

(One-half size.)

FIG. 2.—TYPICAL PISTILLATE ROTUNDIFOLIA CLUSTERS IN BLOOM: *a*, JAMES; *b*, EDEN; *c* THOMAS.

(Natural size.)

FIG. 3.—THREE STAMINATE ROTUNDIFOLIA CLUSTERS IN BLOOM: *a*, AN AVERAGE CLUSTER; *b* AND *c*, TYPES OF CLUSTERS FROM TWO VERY FINE STAMINATE VINES IN THE BREEDING PLAT AT WILLARD, N. C.

(Natural size.)

each of them. A flower cluster of the white seedling was bagged and produced 25 per cent of fruit, which is a very high percentage. One wild Rotundifolia vine with perfect flowers but not self-fertile was reported by Reimer.[1]

(6) In artificial pollination the increased percentage of fruit setting on the commercial varieties is not in proportion to their natural setting. This is because in some varieties all buds on individual clusters become receptive at the same time, while with others the individual pistils become receptive at different times.

(7) The congeniality of fertile pollen varies with different varieties. Thus, a particular staminate vine might be a good pollinizer for a Scuppernong vine but not for an Eden, or vice versa.

(8) Fertile pollen of some Vinifera varieties is not congenial to the leading Rotundifolia varieties.

(9) The average number of blooms and berries per cluster under natural conditions, based on accurate estimates, is shown in Table IV.

TABLE IV.—*Average number of blooms and berries to the cluster of varieties of Muscadine grapes.*

Variety or species.	Average number of blooms to the cluster.	Average number of berries to the cluster.	Variety or species.	Average number of blooms to the cluster.	Average number of berries to the cluster.
Munsoniana	34.5	.....	Eden	48.5	12.9
James	25.3	6.5	Scuppernong	20.1	2
Thomas	31.1	5.3	Memory	14.6	5.5
Flowers	33.5	7.4	Hopkins	16.2	.....

(10) Insects, especially a small beelike fly and a small long-horned beetle (*Copidita thoracica*), are most active agents in carrying pollen from one vine to another.

(11) Where other conditions are the same, fruiting vines growing near male vines set more fruit than those at a greater distance.

(12) There is great variation among male vines relative to size of bloom cluster, date of blooming, length of blooming period, and profuseness of bloom. In planting male vines as pollinizers care should be taken to select only those that bloom at the same time as the fruiting vines they are intended to pollinate.

(13) In large Muscadine vineyards provision should be made to protect the wild male vines growing in near-by woods and fence corners either by planting them in or around the vineyard or by grafting male scions into the tops of a number of the fruiting vines.

VARIETIES.

From time to time reports have been received from persons claiming that vines sold to them were not true to name. The Department of Agriculture has also had a similar experience. While some of this

[1] Bulletin 209, North Carolina Agricultural Experiment Station.

disappointment has undoubtedly been caused by carelessness on the part of nurserymen, much of it is due to a lack of knowledge regarding the identity of the different varieties.

With a view to eliminating the existing confusion regarding the varieties of Rotundifolia, as complete descriptions as possible of all of the more promising varieties are given in the following paragraphs, the varieties being arranged in accordance with their relative value.

Scuppernong.

The name "Scuppernong" as used has more than one meaning. Some apply the word to the entire Rotundifolia species, while others apply it to the cultivated varieties of Rotundifolia in contradistinction to the word "Bullace," which they apply to the wild Muscadines. Still others call the white-fruiting Rotundifolia the white Scuppernong, and the black-fruiting Rotundifolia the black Scuppernong. Again, a great many designate all the light-colored Rotundifolia now under cultivation as Scuppernong. Such a confusion of uses for the same name—and this will become still greater unless stopped—demands either that some understanding be reached relative to its use or that it be discontinued.

The name "Scuppernong" has been in general use too long to be discarded, and a specific definition for it should be adopted. All who have studied the situation, including the horticulturists of the various States of the southeastern United States, will undoubtedly agree that the name should be applied only to a single, white-fruited Rotundifolia which is supposed to have originated in the northeastern part of North Carolina and to which the name was first applied.

This variety is, however, not as clearly defined as it should be, owing to the fact that its origin and early history have not been absolutely determined. The writers have found many so-called Scuppernong vines under cultivation which are not alike and have located wild white-fruiting Rotundifolia, two of them being young vines, in the States of Alabama, Florida, North Carolina, and South Carolina, and widely separated parts of the Rotundifolia territory, and they are further convinced that all nurseries and venders are not selling the same variety as Scuppernong. There seem to be at least three strains of light-colored Rotundifolia among the cultivated varieties of Scuppernong grapes of to-day. The most extensively planted strain has medium-sized clusters and berries. Upon ripening, the fruit of this strain turns a reddish brown and the berries adhere well for Rotundifolia, the fruit even tending to shrivel a little without falling from the stem. It ripens about the middle of September and is thought to be the real Scuppernong, because it was found most abundant in that part of North Carolina where this variety is supposed to have originated. This is the strain referred to in this bulletin wherever the Scuppernong is mentioned as a variety. Another strain ripens about the same time, but has a pearly instead of a bronze color, a thinner skin, smaller seeds, less adherence, and less sugar. A third strain ripens in October after the two just mentioned are gone, has far better adherence to the stem, better bunching qualities, a smaller berry, and higher acidity. These strains have been seen growing side by side, so the differences noted in them are therefore not due to difference in environment.

The Scuppernong is at present the preeminent grape in the Southeast and is the chief representative of the Rotundifolia species. Bulletin 201 of the North Carolina Agricultural Experiment Station deals extensively with the origin and history of the Scuppernong, and independent and simultaneous investigations by the United States Department of Agriculture have also brought out the same facts and conclusions.

The name is of native Indian origin, but the exact origin of the variety is not known. It is supposed to have originated in Tyrrell County, in northeastern North Carolina.

In this section the name Scuppernong has been given to a swamp, a lake (now called Phelps Lake), a river, and a town. The Scuppernong grape is said to have been found on Roanoke Island at the time of the landing of Sir Walter Raleigh's colony, and there is a tradition that an old vine now growing on this island is the original. This, however, has been quite fully disproved, though the vine is very old. Mr. D. Calvin Jones, an agriculturist of note in North Carolina during the early part of the nine-

FIG. 15.—Lower side of a Scuppernong leaf. (Natural size.)

teenth century and agricultural editor of the Raleigh (N. C.) Star, gives the following history of the naming of the Scuppernong grape:[1]

This grape and vine had the name Scuppernong given to them by Henderson and myself in compliment of James Blount, of Scuppernong, N. C., who first diffused a general knowledge of it in several well-written communications in our paper, and it is cultivated with more success on that river than in any other part of the State, perhaps, except on the island of Roanoke.

From the time of its discovery the Scuppernong has steadily increased in popularity. It has been distributed to all parts of the Rotundifolia territory and today is more extensively grown than any other variety.

[1] The American Farmer, vol. 3, 1822, p. 332.

The description of *Vitis rotundifolia* given at the beginning of this bulletin would, in general, suit the Scuppernong. The vine is a vigorous, rank grower, with long, slender, yellowish brown, smooth canes, covered with many very small, light-brown dots or lenticels. The pith is greenish and the tendrils single and intermittent. The growing tips are yellowish or greenish, foliage medium dense, leaves medium size, cordate, with an average width of 2½ inches and a length of 3 inches, margin mediumly serrate, and texture thin in comparison with other Rotundifolia varieties. (Figs. 15 and 16.) The flowers have reflex stamens and open about May 27 in North

FIG. 16.—Upper side of a Scuppernong leaf. (Natural size.)

Carolina. The cluster (Pl. VII, fig. 2) is round, small to medium size, moderately compact, having 1 to 15, but generally 2 to 6 berries to the cluster. The berries are large, averaging three-fourths of an inch in diameter, round, and, when fully ripe, bronze or reddish brown in color, ripening the middle of August in Florida and the middle of September in North Carolina. The berries often ripen unevenly and when fully ripe fall readily from the clusters. The skin is medium thick, tough, covered with numerous small but prominent russet dots and sometimes russet blotches, but contains no pigment. The flesh is generally pale green, very juicy, tender, soft, fine grained,

musky, sweet and sprightly, and of good quality. The flavor is distinctly "scuppernong," sweet, sprightly, and agreeable when the berries are fresh, but deteriorating rapidly after picking. The seeds are large, typical of Rotundifolia, adhering slightly to the pulp. This variety is suited for home use and wine making, and thrives best on well-drained, sandy-loam soils, bears abundantly, though not as much as some of the dark varieties, and is also more susceptible to black-rot. This is the only Rotundifolia variety at present in demand by large wineries.

Flowers.

The Flowers variety is the oldest black Rotundifolia in cultivation. It was discovered in 1819 growing in Flowers Swamp, 15 miles south of Lumberton, Robeson

FIG. 17.—Upper side of a Flowers leaf. (Natural size.)

Co., N. C., on the road from Lumberton to Fair Bluff, by "Popping Billy" Flowers, and transplanted by him to a place a few hundred yards away. It has since been grown quite extensively for home use in the section where it was found, and is considered second only to the Thomas, which was discovered about 25 miles farther south. The spot on which the Flowers was found is a sandy loam considerably elevated above the surrounding lands and it thrives best in similar locations. The vine

has an upright, slender growth, more open than and hardly as vigorous and robust as other Rotundifolia varieties.

The leaves (figs. 17 and 18) vary in size but average $2\frac{3}{4}$ inches in width and $3\frac{1}{4}$ inches in length and are thick, rather dark green, slick, leathery, cordate, with sharp-pointed tip and a margin sharply serrate.

The cluster is large for Rotundifolia, almost round, of medium compactness, containing generally from 6 to 10 medium-sized purplish black berries slightly oval in shape. (Pl. III, figs. 1 and 2.) The skin is very thick and tough and only faintly

FIG. 18.—Lower side of a Flowers leaf. (Natural size.)

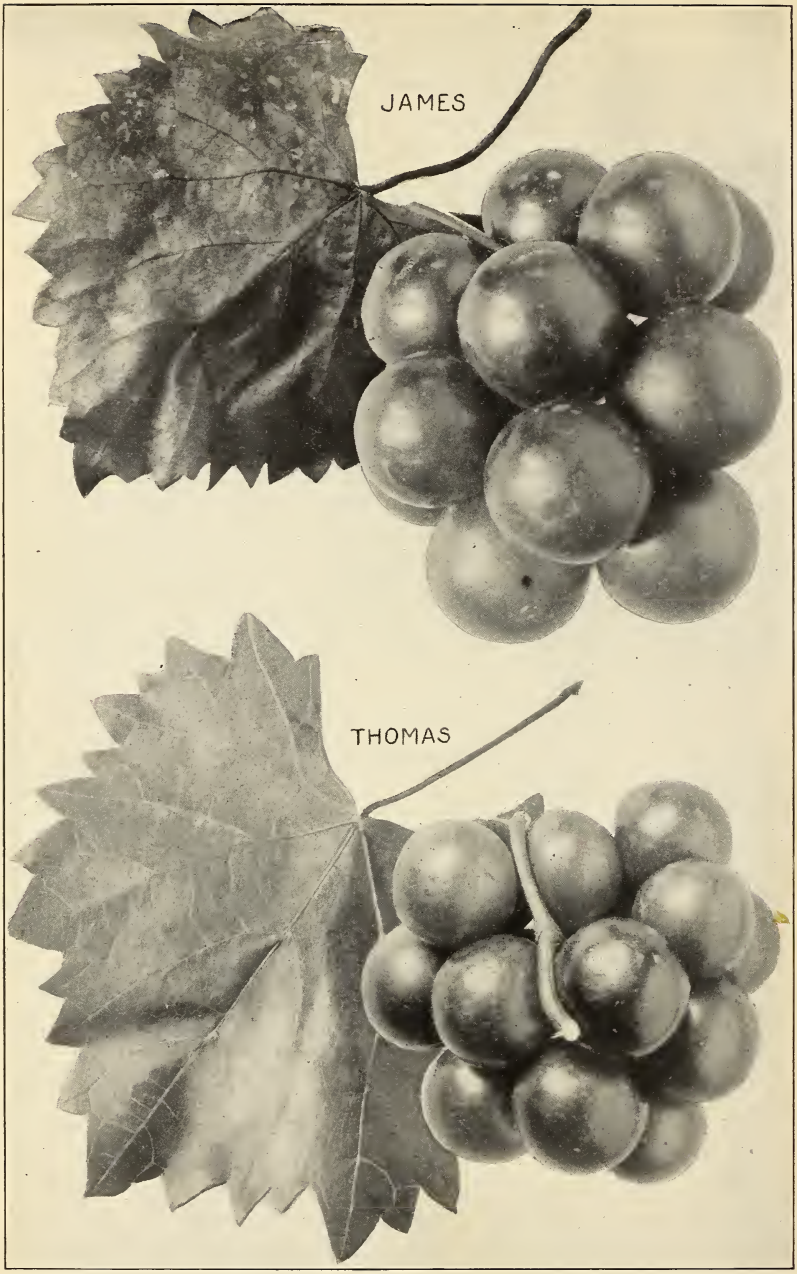
marked with dots. The flesh is white, meaty, tough, and not very juicy, containing three to four seeds, parting with difficulty from the pulp and more angular and square than the other varieties. The flavor is sweetish, lacks sprightliness, and is of medium quality.

The distinguishing characteristics of the Flowers variety are a strong tendency to bunch, a strong adherence to the peduncle, good shipping qualities, late ripening, coarseness and meatiness of flesh, and thickness of skin, differing in all these respects from any of the other varieties with the exception of the Luola, which ripens at the same time.

FIG. 1.—VIEW OF SWANS POINT, WHERE THE MISH GRAPE WAS DISCOVERED.

FIG. 2.—ORIGINAL SITE OF THE THOMAS VINE, MARION, S. C.

FIG. 3.—ORIGINAL JAMES VINE WITH THE OWNER, MR. B. M. W. JAMES, SEATED BENEATH, GRINDOOL, N. C.



CLUSTER AND LEAF OF THE JAMES GRAPE AND OF THE THOMAS GRAPE.
(Natural size.)

The Flowers variety is principally used for wine, although the wine made from it is not as good as that made from either the Scuppernong, Mish, James, Thomas, or Memory variety. It appears to be well adapted to the soils of both North Carolina and South Carolina. It is found to thrive in northern Florida and is said to do well as far south as the Florida Keys. The berries adhere to the bunch better than those of any other Rotundifolia variety now in cultivation, the fibro-vascular bundles from the peduncle extending into the berry before breaking, instead of breaking at the peduncle, which makes it a good shipper. It is also one of the best, if not the best bearer. In the Rotundifolia experiment vineyard at Willard, N. C., at 3 years of age, the Flowers and the Eden yielded 57 bushels an acre, as compared with 36 bushels an acre from the James and Thomas varieties.

James.

The James was discovered by Mr. B. W. M. James, of Grindool, N. C., about 1866 or 1867, growing not far from Grindool Creek, a few hundred yards from Grindool post office, now called Whitehurst, located in Pitt County, N. C., about 3 miles south of Parmele, N. C., on the Weldon and Kinston division of the Atlantic Coast Line Railroad. Mr. James said that when he discovered the vine growing in the woods it was only a few inches long with only one bunch of grapes. This bunch, however, had 9 or 10 berries, which were very large and remained on the vine in good condition for a long time. A grape with such qualities, he thought, should have attention so he determined to place it under cultivation.

While taking it up to transplant it to his home, a few hundred yards away, Mr. James accidentally broke it off, leaving only about 1 inch of root attached. The vine is still growing and covers an arbor about 20 feet in diameter. Mr. James died in May, 1907, and his son Charles now owns the old homestead and the original vine. (Pl. VIII, fig. 3.)

The soil in this section of North Carolina is a fine sandy loam with a clay subsoil and is considered a good, strong soil. Soils of this character, comprising a large portion of Pitt and Edgecombe Counties, produce a large proportion of the grapes now grown in the State, the James being the most extensively planted variety and is there usually considered superior to any other. Good cotton and tobacco crops are also grown in that region.

The general appearance of the James vines is similar to that of the Mish, the principal difference being in its habit of growth, which is more trailing, and the foliage, which is, perhaps, a little thinner and lighter in color. The vine is vigorous and productive and readily adapts itself to systematic training on an upright trellis. The leaf is cordate, with a serrate margin and averages $2\frac{1}{2}$ inches in width by $2\frac{3}{4}$ inches in length. In late summer the space between the prominent veins turns yellow long before the part next to the veins, giving the leaves a pronounced mottled yellow and green appearance not noted in other varieties at the same time.

The cluster appears large on account of the size and not the number of the berries. It contains from 2 to 12 berries, sometimes more, but usually 4 to 6 berries, is moderately compact, and round. (Pl. IX, fig. 2.) The stem is $1\frac{1}{2}$ to $1\frac{1}{4}$ inches in length. The berries are large, round, rather glossy, bluish or deep purplish black when fully ripe, with pronounced, though not very numerous, "guinea egg" specks. When not entirely ripe there is a rather characteristic reddish coloring around the peduncle. The berry is juicy, though the flesh is meaty, and the skin is thick and rather tough. The seeds are typical, adhering somewhat strongly to the pulp and averaging larger in size than those of other leading varieties. The flavor is of medium quality, the berries that ripen in the shade being of much better flavor than those ripening in the sun. The free-run juice is also superior.

The James variety is not grown much outside of North Carolina, although it appears to do well as far south as Florida. It probably ranks third in the quantity of fruit produced for all purposes and first in shipping qualities. It must have careful handling in shipping, and with care can be sent to northern cities with good results. The fruit resembles that of the Mish more closely than any other of the standard varieties, but is larger, rounder, glossier, and darker, less speckled, ripens earlier, is juicier, not so sweet, and has harder pulp. Its handsome appearance, juiciness, productiveness, fair quality, and good adherence to the peduncle make the James the best general-purpose variety of Rotundifolia.

Mish.

The Mish grape, according to Capt. George Brown, Walter A. Mish, and others of Washington, N. C., was discovered by Mr. Albert Mish between 1840 and 1850 growing in pure river sand, near the edge of the Pamlico River at Swans Point, 4 miles south-

FIG. 19.—Upper side of a Thomas leaf. (Natural size.)

east of Washington, N. C. (Pl. VIII, fig. 1), and was transplanted to his home, a short distance away. The vine grew and covered a large white-oak tree in front of Mr. Mish's residence, where it remained until a few years ago, when it was uprooted during a heavy storm. It was prized very highly from the time of its discovery and was soon distributed by Mr. Mish among his friends throughout eastern North Carolina. The soil where the vine was discovered is very sandy, varying from river sand to dry sandy loam. A fair growth of oak, pine, and other timber occupies the virgin soil and good crops of corn, cotton, and sweet potatoes are produced in the immediate vicinity.

CLUSTER AND LEAF OF THE FLOWERS GRAPE AND OF THE EDEN GRAPE.
(Natural size.)

The Mish vine resembles both the James and Flowers in general appearance, but is more like the James and is of about the same vigor. It has an upright habit of growth. The leaf is thick and rather round, with an average width of $2\frac{3}{4}$ inches and an average length of 3 inches.

It has a fair tendency to bunch and the berries adhere fairly well to the peduncle. The berries range from about eleven-sixteenths to three-fourths of an inch in diameter, are slightly ovoid, almost black, with numerous "guinea egg" specks, tender, juicy, and sweet. (Pl. XI, fig. 2.) The skin is medium thin, cracking in wet weather. The seeds number two to four and are of medium size, coming to a sharp point at the base. The fruit ripens just after the James. The flavor is distinct, delicious, and

FIG. 20.—Lower side of a Thomas leaf. (Natural size.)

of good quality. This variety is considered by wine men second only to the Scuppernong for wine purposes and is second only to the James as an all-purpose grape, but in yield it does not equal the James variety. It is regarded as the best grape of all in the district where it originated and is almost the only variety planted there. The crop ripens uniformly, a very good character for a wine grape, and this, together with a high sugar content, the character of the foliage, the size, shape, and markings of the fruit, its fine flavor, small seed, and fairly good adherence to the peduncle are distinguishing features.

Thomas.

The Thomas grape was discovered by Mr. Drewery Thomas between 1850 and 1855 growing near a springhead, 4 miles northwest of Marion, S. C., and about 1 mile from

Catfish Creek on what was then Mr. Thomas's land but which is now owned by Dr. W. W. Hamilton, of Marion, S. C. (Pl. VIII, fig. 2.) Mr. Thomas transplanted the vine to his home (now owned by H. C. Graham, of Marion, S. C.), a few hundred yards from where it was found. Mr. Thomas died several years ago, but the history of the variety is well established by Dr. W. W. Hamilton, Thomas Fore, and other citizens of Marion. There are at present several old arbors at the Thomas place and in all probability one of these is the original.

The soil where the vine originated is a fine sandy loam with a clay subsoil. The land was originally heavily timbered and produces good crops of corn, cotton, and

FIG. 21.—Upper side of an Eden leaf. (Natural size.)

sweet potatoes. The Thomas grape is said to be hardier and longer lived than the Flowers in this section. The vine and wood resemble the Scuppernong, differing mainly from it in that the young shoots and the petioles of the young leaves are darker, a little thicker, and more serrate. The width of the leaves is about 3 inches and their length about 3½ inches. (Figs. 19 and 20.) The growth is about the same. The clusters are rather small and very compact, with a short stem, too short to hold in picking the fruit. (Pl. IX, fig. 1.) The berries are of medium size, round, dark-wine color when fully ripe, and surrounding the base there is a wide, prominent greenish or yellowish irregular pentagonal marking. The flesh is tender, juicy, very sweet, and has an exceptionally rich, sprightly, and fruity flavor. The skin is thin and moderately

CLUSTER AND LEAF OF THE SCUPPERNONG GRAPE AND OF THE MISH GRAPE

Natural size.

tough with numerous small pimples dotting the surface. The seeds number three to four and are about the same size as those of the Flowers variety, but are more oval and flattened. The fruit ranks the highest of the Rotundifolia in sugar content, and those who know the variety prefer it to all other Rotundifolia varieties as a table grape. It makes a good wine. It is apparently, with the exception of the Scuppernong, the most widely distributed of the Rotundifolia varieties, but is not so extensively planted as the James, Mish, or Flowers, and is not grown in large quantities. It ripens very unevenly, the berries on the same cluster ripening several days apart. This and its poor adherence to the peduncle are strong objections to the variety.

FIG. 22.—Lower side of an Eden leaf. (Natural size.)

Often the first berries to ripen fall off before the later ones, even on the same cluster, are ripe. However, every home vineyard should have sufficient Thomas vines to supply the table, for it is recognized as the best table grape among the Rotundifolia.

Eden.

The Eden grape was discovered on the premises of Dr. Guild, east of Atlanta, Ga., and was introduced by Dr. Samuel Hape, of Hapeville, Ga. The soil in this region is the typical red clay of the Piedmont section and this variety is said to be well adapted to it. The Eden is the only variety of this group discovered in such soil. It is a remarkably vigorous grower, with dense foliage and dark-colored wood.

The leaves are of medium thickness, with wide basal sinuses similar to *Vitis munsoniana*, and while the other commercial Rotundifolia varieties have cordate leaves with sharp, jagged margins the Eden has rounded leaves with rounded marginal teeth and blunt tip. (Figs. 21 and 22.) The tip of the leaf is sometimes concave V-shaped, though generally convex and pointed, and it averages 2¾ inches in width by 2¾ inches in length. The bunch is also quite distinctive and resembles *V. munsoniana*, is very loose, containing from 5 to 25 berries and is cymelike, with a long stem breaking at a joint midway between the cane and berries. The clusters are easily gathered and the berries on individual clusters ripen uniformly, though the vines produce distinct first and second crops. (Pl. X, fig. 2.) The berries are round, about half an inch in diameter, dull black when first ripe, faintly speckled, and adhere fairly well to the peduncle. The flesh is soft, juicy, and colorless, with a pleasant flavor, though tart even when entirely ripe. The quality is very good, the skin is relatively thin and tender, and the seeds are small.

The Eden is adapted for wine, home, and kitchen use. It is remarkably productive and an excellent vine for arbors and summer houses. In the Rotundifolia experiment vineyard at Willard, N. C., it has yielded more than any other variety. It is also the most distinct in type, the earliest and most vigorous in growth, and one of the earliest to ripen. It is somewhat difficult to train on an upright trellis, because of the tendency of certain shoots to take the lead and crowd out all the others. There are many things about this variety which suggest both the Rotundifolia and Munsoniana, and it is possible that the Eden may be a natural hybrid between them. Some also think that it may be a natural hybrid between the Rotundifolia and a bunch-grape variety.

Memory.

The Memory grape was discovered between 1868 and 1870 by Col. T. S. Memory in his vineyard in the town of Whiteville, N. C. Col. Memory was a grape grower and owned a third interest in the old grape nursery of Ellis & Co., at Whiteville, N. C. About 1872 he bought out the firm and conducted the business under his own name until his death, in December, 1896. The firm handled the following varieties: The Scuppernong, Flowers, Thomas, Tenderpulp, Sugar, and, later, Mish, Memory, Pee Dee, and Flowers Improved. Col. Memory propagated the Memory variety extensively and distributed it over the entire Rotundifolia territory, especially in North Carolina, Georgia, and Texas. It grew up under a Thomas vine, resembles the Thomas variety in many respects, and is probably a seedling from it. The discoverer, in a pamphlet describing the variety he had for sale, said:

> Memory was discovered since the late war in my vineyard among some Thomas grapevines, and no doubt is a seedling of the Thomas; is much larger than Thomas; ripens in September. It is much sought after where it is known.

After the death of Col. Memory the vineyard passed into the hands of his son, Mr. J. L. Memory, who was not interested in grape growing at the time and destroyed nearly all the vines, including the original Memory vine. Later he became interested in grape culture, and is now growing plants from a large vine at Whiteville which was propagated directly from the original and now belongs to his sister. The original Memory vineyard was on an elevation about 15 miles from the place where the Flowers variety originated, the soil being typical Coastal Plain sandy loam underlain with clay.

The vine is quite vigorous. It holds its foliage better than most varieties during drought and also well into the fall. The leaves are of medium size, averaging 2¼ inches in width by 3¼ inches in length. They are cordate, quite pointed, with a margin medium serrate, rather thick, dark, and leathery. The first fruit ripens about August 10 in Florida and about September 1 in North Carolina. The cluster is round, fairly compact, and consists of from two to eight berries, which adhere to the peduncle

until they shrivel. The berries are slightly oval, measuring about $\frac{5}{8}$ to $\frac{3}{4}$ by $\frac{7}{8}$ to 1 inch. They are black, with a reddish coloring next to the peduncle when not fully ripe, and sometimes with rough, irregular, russet spots upon them. The flesh is white, with a medium juiciness and pulpiness. The flavor is excellent, sweet, and of good quality. The skin is rather thick and tough, and there are two or three medium-sized seeds. The vine is very productive. The Memory variety stands shipment well and is an excellent table, kitchen, and wine grape. Where it is known

FIG. 23.—Upper side of a Luola leaf. (Natural size.)

in Florida it is considered the best all-round black variety and deserves to be much more extensively grown. Its fine flavor and good shipping qualities are its two best attributes.

Hopkins.

The exact origin of the Hopkins grape is not known. From what can be learned it is supposed to have originated near Wilmington, N. C., and the oldest known vine, supposed to be the original, is on Mr. W. B. McClellan's farm, about 2 miles northeast of that city. This vine is healthy and vigorous, with large, dark-green, thick,

broadly cordate, irregular, dentate leaves. The clusters have small, easily detached stems and resemble those of the Scuppernong. The berries are large, five-eighths of an inch to 1½ inches in diameter, black, and slightly oblong. The flesh is pulpy but soft, with a flavor that is sweet and pleasant. The skin is medium thick and tough, and there are from two to four large seeds. The vine is very productive. The fruit ripens very early, generally about the last of August at Wilmington, N. C. This variety has been extensively grown by Mr. Ollen E. Warren, of Greenville, N. C., who has in his collection the Flowers, Mish, James, and Scuppernong varieties, besides

FIG. 24.—Lower side of a Luola leaf. (Natural size.)

the Hopkins, and the Hopkins appears to be the healthiest and most vigorous of them all. Its vigor, flavor, earliness, size, and the appearance of the berry are its distinguishing features.

Luola.

The Luola variety was discovered 20 or 25 years ago by Mr. G. W. Lennon's father, on his place 6 miles northeast of Boardman, 14 miles northwest of Whiteville, and 17 miles southeast of Lumberton, N. C., about 8 miles from where the Flowers originated, and about 30 yards from Oakey Branch. It is still growing where it was discovered, and it, together with some young vines in the cooperative Rotundifolia experiment

vineyard of the Department of Agriculture, and two young vines at Lumberton, N. C., are all there are in existence. This grape closely resembles the Tenderpulp, but ripens later, is of better flavor, and hangs on until frost. The leaves are cordate, pointed, broadly serrate, and are above medium size, being $2\frac{3}{4}$ inches in width by $3\frac{1}{2}$ inches in length. (Figs. 23 and 24.) The clusters are of medium size, rather loose, with berries of a dark purplish black, round, melting, juicy, fruity, and vinous. The skin is thin and tender and the seeds small. This variety ripens just before frost.

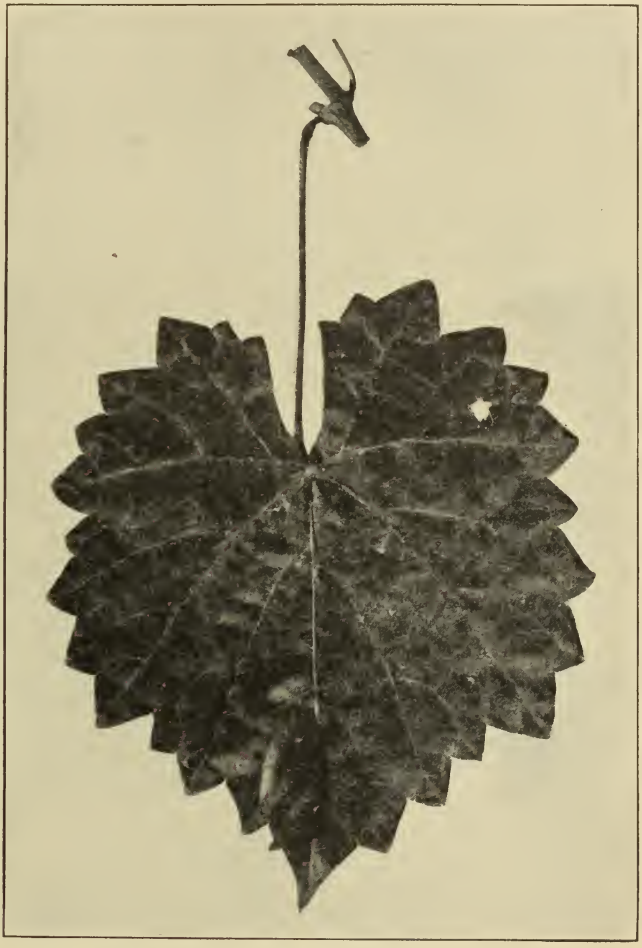


FIG. 25.—Upper side of a Smith leaf. (Natural size.)

The soil where this variety originated is a fine sandy loam, with clay subsoil and resembles the Chadbourn strawberry soils. The Luola differs from all other known Rotundifolia varieties in its very tender skin and small seeds.

Smith.

The Smith, sometimes called Smith's Improved, was discovered growing on light, sandy soil by Mr. C. J. Smith, of Alberston, Duplin Co., N. C., about 20 years ago. The original vine is still standing, the timber, which was of medium growth, hav-

ing been cleared away from around it. Mr. Smith has several arbors of it. At Kinston, N C., it is considered a very fine grape for home use. The vine is vigorous and productive, upright, but rather trailing in its habits. The leaves are cordate, rather thick, and not much pointed. (Figs. 25 and 26.) The clusters are of medium size and roundish; adherence to peduncle very good. The berries are $\frac{7}{8}$ by 1 inch in diameter, oblong, bluish or deep purplish black, and when fully ripe have very distinct "guinea speck" markings. The skin is tough and the seeds fewer in number

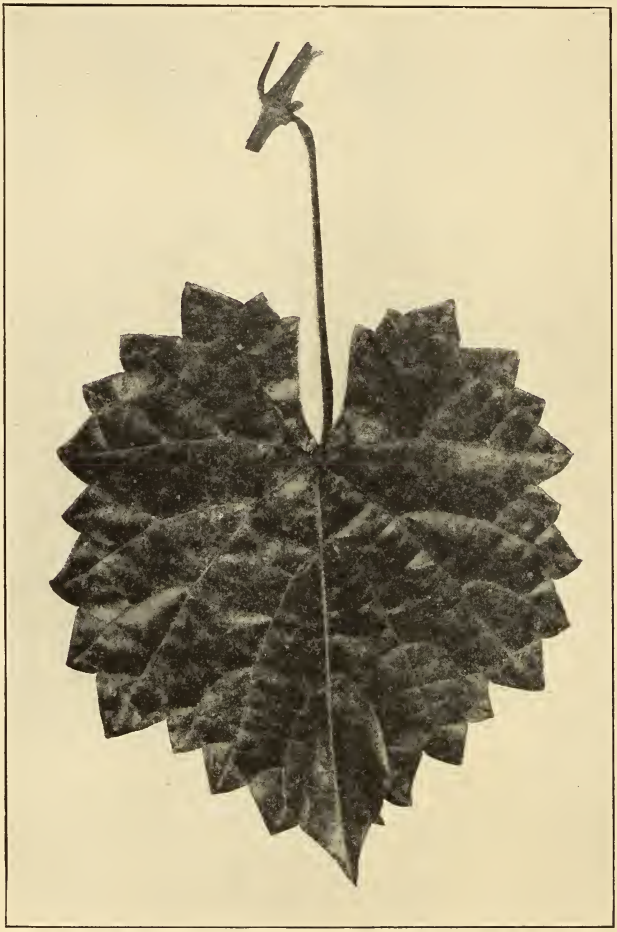


FIG. 26.—Lower side of a Smith leaf. (Natural size.)

than in most varieties. The Smith ripens early, hangs on the vine until frost, and is considered a good shipping variety. The fruit resembles the Memory.

Lady James.

The Lady James grape was discovered about 25 years ago, by Mr. B. M. W. James, of Grindool, Pitt Co., N. C., who also discovered the James grape. It grew near his vineyard and Mr. James supposed it to be a seedling of the James, but because of its more refined qualities and texture named it the Lady James. Its fruit resembles

the Thomas very closely in every respect. The clusters are of medium size and very compact, with a short stem, making it hard to pick. It has berries of medium size, round, and of a reddish wine color when fully ripe, with prominent greenish or yellowish pentagonal markings at the peduncle. The skin is thin and moderately tough, with numerous small pimples dotting the surface. The fruit is juicy and sweet, and the flavor sprightly. The vine has an upright but rather trailing growth. The fruit is recommended for home use only.

Latham.

The Latham was discovered by F. P. Latham, before the Civil War, 3 miles from Newbern, N. C., near where Brook Creek empties into the Neuse River, and the original vine is believed to be from 55 to 60 years old. Mr. Latham transplanted it to his home on the other side of the Neuse River, 2 miles from Newbern.

This grape closely resembles the Thomas and Lady James in growth, habit, and character of fruit. It is propagated to some extent in that section, being esteemed as a dessert and wine grape. The clusters are compact and of medium size. The stem is very short, holding the cluster closely to the cane. The berries are of medium size, round, of wine color, with prominent pentagonal markings on berry at the peduncle. The skin is thin but moderately tough, sprinkled over with pinhead dots. The fruit is juicy, exceedingly sweet, and of a sprightly flavor. Mr. Latham says that this grape tests higher in sugar by 2½ per cent than any other variety in that section. The soil around the Latham home is sandy to loamy and is slightly above the water line. The land is usually heavily timbered and appears well adapted to the growth of grapes.

Pee Dee.

The Pee Dee was first brought to notice by Dr. H. Williamson in the early sixties, and is said to be a chance seedling discovered at Darlington, S. C. It was for a time listed in the catalogue of the P. J. Berckmans Co., of Augusta, Ga., but has now been discarded by them. The only known vines of the variety are to be found near Darlington. Pee Dee is of interest because it is a white-fruited variety of Rotundifolia known to be distinct from the Scuppernong. The fruit is smaller and ripens later, but otherwise is similar to the Scuppernong. The Pee Dee is recommended for home use only where a late white variety is desired.

Sugar.

The Sugar, sometimes called the Sugar Pulp, is thought to have been discovered near Whiteville, N. C., by the late Col. T. S. Memory, who discovered and introduced the Memory grape. The Sugar was distributed about 1900 by Ellis & Co., the firm of which Col. Memory was a member. There are a few vines located at various places in North Carolina. The largest plantings are those of Mr. E. C. Carraway, 9 miles from Kinston, and Mr. H. L. Pritchard and Mr. R. Elliott at Skinnerville, N. C. This variety can not be recommended for general planting. The following is a brief description of it:

The vine is rather vigorous, productive, and upright, with a cordate, regularly dentate leaf. The cluster is round and of medium size with round, sleek, black berries five-eighths to seven-eighths of an inch in diameter. The flesh is soft, not very sweet, fairly juicy, and of medium quality. The skin is thick and tough, and the seeds large. This variety ripens about October 1 in North Carolina and is in season until frost.

Carolina Belle.

The Carolina Belle was planted by Mr. Elisha Lamb 18 or 20 years ago on his estate, which is now owned by Mr. W. K. Hindreen, of Dwight, N. C. It is thought to be a chance seedling that came up near some hogpens on Mr. Lamb's place. The variety is of small commercial importance, but is propagated to some extent near Dwight, N. C. The vine is a very rapid, distinctly upright, open grower. The leaves are cordate, sharp pointed at tip, have a sharp, serrate margin, are medium dark green, glabrous, and leathery. They vary in size, but average from 2½ to 3½ inches in length. The clusters are of fair size, with berries of medium size, oblong, almost black, with

frequent small specks, fairly juicy, and of medium quality. The skin is thin but tough and the seeds small. The Carolina Belle ripens two weeks earlier than the Mish, but is inferior to it in quality.

Beula.

The Beula grape originated about 40 years ago as a chance seedling in the vineyard of the late Benjamin F. Meekins, at Manteo, N. C. The old vine, erroneously called the "Original Scuppernong," and said to have been set out by Sir Walter Raleigh, is located in the same vineyard. Mr. Meekins had four or five arbors of the Beula at the time of his death in 1909, considering it a valuable grape. After its discovery the variety was brought to notice by Mr. Fred Proctor, of Manteo and Elizabeth City, N. C., who died about 15 years ago. The vine is a vigorous to rank grower and is upright and branching, with brown canes and dense foliage. The leaves are of medium size, averaging $2\frac{1}{4}$ inches in width and $3\frac{1}{4}$ inches in length, dark green, cordate, and have a medium serrate margin. The cluster is round and of fair size, with large brownish black berries, flattened at base, meaty but juicy, and of medium flavor and quality. The skin is thick and tough and the seeds typical. We have never seen this variety growing anywhere except at the Meekin place and at the Medoc Vineyard, Enfield, N. C. The Beula is very productive, but is suited only for wine, and there are other varieties that surpass it for this purpose. It can be easily recognized by its large dorso-ventrally flattened berries.

Tenderpulp.

The Tenderpulp was discovered by Mr. D. P. High at Whiteville, N. C., about 1868, growing in his vineyard as a chance seedling. It soon fell into the possession of nurserymen and was quite generally distributed. Mr. High himself never considered the variety worth planting and the writers do not recommend it. It is superior to the wild grapes only in its tenderness of pulp; even in this respect it is inferior to several other varieties and is not of sufficient importance to warrant a description.

Clayton.

The Clayton grape in some respects resembles the James, in others the Mish variety. It was found by Col. Clayton Griffin on Swans Point within 50 yards of where the Mish vine was discovered and transplanted to his home, where the original vine now is. Mr. Griffin is dead, but the place is still owned by his widow, Mrs. Ellen Griffin. The variety has never been tested and at present does not warrant a description. It is, however, a good variety and deserves further trial.

Westbrook.

The Westbrook grape originated as a chance seedling at the home of the late Mr. J. S. Westbrook, at Faison, N. C. When Mr. Westbrook moved to Wallace he took some plants with him. The variety is now grown to a limited extent, but is not considered of sufficient importance to warrant a description.

Brown.

Mr. J. I. Brown, of Kinston, N. C., has a small reddish variety of Rotundifolia which he has named the Brown grape. It is a seedling that came up about 15 years ago on an old breastwork near by. Both vine and fruit are similar to the Scuppernong, the fruit being, perhaps, sweeter, a little better in quality, and thinner skinned. The berry is smaller and ripens later and is, perhaps, more inclined to cluster. This variety is being tested in a small way in the Rotundifolia experiment vineyard.

San Jacinto and other hybrids.

Prof. T. V. Munson, Denison, Tex., has introduced several hybrids, of which the San Jacinto is the best known. The San Jacinto and the La Salle are the result of crossing the Scuppernong with a Post Oak variety, and the others, Dixie, Howard, Labama, Marvel, "R65 No. 5," "R66 No. 11," Sanbrilasco, San Gabriel, Sanherbo, Sanalba, Sanrubra, Sanmelaska, and Sanmonta are all crosses between the San Jacinto and the Brilliant or the Herbemont. As yet these varieties are of interest only from a plant-breeding standpoint.

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